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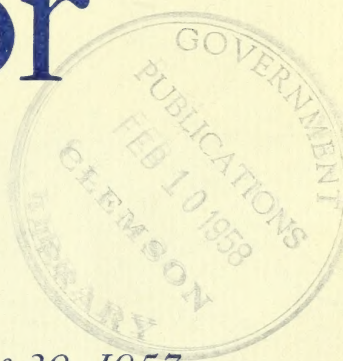
1957 Annual Report

SECRETARY OF THE

Interior

FRED A. SEATON

For the Fiscal Year Ended June 30, 1957



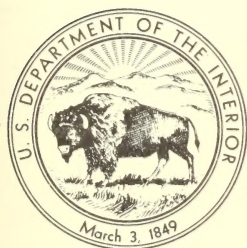
Developing America's Resource Base

1957 Annual Report

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Developing America's Resource Base

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THE SECRETARY OF THE INTERIOR
WASHINGTON

MY DEAR MR. PRESIDENT: Transmitted herewith is the annual report of the Department of the Interior for the fiscal year which ended June 30, 1957.

The activities of the Department's bureaus and offices, as summarized in this report, indicate the measure of continuing progress which is being made in the conservation and development of the Nation's natural resources. We feel that the accomplishments of the past year give ample proof that the goals of intelligent conservation and orderly development of natural resources are thoroughly compatible.

While the report indicates that substantial progress is being made, many natural resource problems demand our fullest attention. We shall continue to work earnestly and creatively to insure that the resource requirements of today and tomorrow are fully and efficiently met.

Sincerely yours,

James A. Seaton
Secretary of the Interior.

THE PRESIDENT,
THE WHITE HOUSE,
Washington, D. C.

United States
Department of the Interior



Fred A. Seaton, *Secretary*

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PART I

DEVELOPING AMERICA'S
RESOURCE BASE

Developing America's Resource Base



THE DYNAMIC ECONOMIC STRENGTH of modern-day America depends upon the full and creative development of our country's natural resource base—our mineral wealth, our vast plains, our timber-laden forests, and our flowing rivers and streams. In peace and war, these resources have met the needs of our Nation and have provided the sinews for the most highly developed industrial machine the world has known.

Our resources, however, are far from inexhaustible, and as our national output rises, corresponding depletions are made in the storehouse of nature's bounty.

Predictions are being made, in fact, that by the middle of the 21st century, the world's population will have increased 4 or 5 times. In this world of tomorrow, the predictions continue, people will face a grim struggle for existence, with their food and water in short supply and their reserves of many minerals exhausted.

No one really knows, of course, whether such predictions will ever come true. Human resourcefulness, ingenuity and invention should be able to prevent such a calamity. Our Nation, however, must work creatively to provide for the realistic development of its natural resource base in order to meet the growing demands of today's citizens and to pass along our resource heritage to generations of unborn Americans.

This is the task of the Department of the Interior, which has centered its activities on helping meet constructively both the immediate and long-range requirements of our expanding economy. Although directed toward harnessing natural resources for the peaceful pursuits of our people, the contribution of the Department's efforts to our national security in a troubled world cannot be overestimated.

Demands of the Future

Our economy is changing while it expands at an accelerating pace. Science and technology, together with a rising standard of

living, are creating new demands for goods and services which were unknown just a decade ago. As a result, the total drain on our natural resources will continue to increase in the years ahead.

In 1975, our population will need about 450 billion gallons of water per day—about twice as much as is consumed today. Electric power capacity will have to be increased from 123 million kilowatts in 1956 to 321 million kilowatts by 1975.

This task of developing our natural resources to meet future requirements is gigantic, and the possibilities of irretrievable losses are ever present in man's effort to utilize nature's gifts.

Moreover, major decisions relating to the development of our natural resources have implications for the distant future. For example, investments in a multipurpose dam may yield returns over many decades. Likewise, the failure to initiate a watershed or fishery-protection program may place a region at a permanent disadvantage. Sound planning is essential if we are to derive full benefit from our natural resources. The alternative is waste, inefficiency, and shortages.

Resource Problems Are Complex

Resource development projects have become larger and more complex in recent years. For example, construction and operation of a multiple-purpose dam may involve decisions on the use of water for irrigation, for industrial and household use, for electric power, for commercial and sports fisheries, and for boating, swimming, and hunting.

These decisions concerning the competing uses for water cannot, and should not, be made by the Department of the Interior or the Federal Government alone. They require the closest cooperation among all groups and individuals, both private and public, if we are to achieve the maximum development and optimum use of this most vital natural resource.

Similar problems arise from the competing demands for the use of public land resources. While in many instances it is possible to provide for multiple uses of the same land, certain cases may arise in which the proposed uses are in such sharp conflict that a specific choice must be made.

Increased Costs a Factor

The most serious problems facing our natural resources industries arise, paradoxically, as a result of the high level of economic activity which we have been enjoying. The unprecedented output of our

farms, factories, and mines is causing tremendous drains on some of our basic resources.

Some of the conventional sources of electric power are becoming less abundant and more costly, and most of the nation's low-cost hydroelectric power sites have been developed. The Federal Power Commission has estimated that in the next 20 years, falling water can provide only 8½ percent of our new electric generating capacity, except at a substantially higher cost. We must continue our unremitting search for new sources of low-cost energy if we are to meet our growing needs.

Our increasing consumption of minerals is causing heavy depletion of our highest grade low-cost ores. Unless we can find ways of using economically our low-grade ores and making greater use of those minerals which are still abundant, we will encounter sharply rising costs for our minerals and fuels.

The economic forces which are exerting an upward pressure on the costs of producing electric power and minerals are also making themselves felt in the development and use of our water resources. If we do not conserve and use our water supply more effectively, some regions of our country face the prospect of paying an excessively high price for water.

Recreational Values

While many activities of the Department of the Interior deal with material things, we know that achievement of the good life for all citizens involves more than goods and services. There are countless opportunities for growth and fulfillment which are offered by our great outdoor recreational areas, our historic shrines, and our fish and wildlife resources.

Our rapid economic growth is having a profound impact not only on our energy, water, and mineral resources but also on our scenic, wilderness, and historic areas, as well as on our fish and wildlife habitats. With rising incomes, more spare time, and better transportation, increasing millions of people are visiting our national parks, other recreational areas, and hunting and fishing grounds.

To accommodate this rapidly growing throng of American families seeking pleasure in their country's vast outdoors, the facilities of our National Park Service must be improved and increased impetus must be placed on the development of our fish and wildlife resources.

The sections of this report which follow describe the programs of the Department of the Interior for the development of our Nation's natural resource base to meet those challenges of the future which have been briefly described in the preceding pages.

DEVELOPMENT OF MINERALS AND FUELS

An expanding minerals resource base continues to be essential to the military security and economic health of our Nation, both today and in the future. Maintaining these resources becomes more complex and more important as our better-grade sources of metals and liquid fuels become depleted. In this area, the Department of the Interior bears heavy responsibilities.

The Department conducts many programs to discharge its duties in the development and expansion of the Nation's mineral resource base. It gathers and interprets facts on our domestic mineral position, conducts scientific and technological research and investigation, and provides financial aid for private exploration for new sources of critical and strategic minerals and metals.

In addition, the Department acts as minerals adviser to other Federal agencies and conducts programs to promote health and safety standards in mineral industries.

Minerals for Many Purposes

The diversity of our current industrial requirements for metals and fuels, as well as conservation responsibilities for the needs of future generations, complicate the Department's duties in the realm of mineral resources.

In presenting its long-range minerals program to Congress in 1957, for example, the Department listed 75 mineral-commodity groups, each presenting special technological and economic problems.

Although the overall task of developing adequate mineral supplies remains constant, there also are many immediate problems which arise because of rapidly changing conditions. The United States at one time, for instance, was considered deficient in rare-earth minerals, but large reserves have now been discovered. Demands for special fuels and new minerals and alloys have been created as air-defense emphasis shifts. New advances in the field of medicine have established additional markets for high-purity metals, and the peaceful application of nuclear energy requires the development of many different minerals and mineral products.

Research Basic to Action

For Government and industry, the Department collects and interprets facts on mineral reserves, production, and future requirements both in the United States and abroad. Many decisions affecting our economic well-being and military preparedness are based on such data provided to policy planners.

Factual information on our country's present and future mineral position also must be accompanied by recommendations to effect remedies for existing and predicted deficiencies. Our Nation's ability to maintain adequate supplies requires technological programs, long-range in nature, for the discovery of new deposits and for new ways of developing our existing supplies most efficiently. In this field, many programs involve resurveys of submarginal deposit areas, as well as new methods of processing complex and low-grade materials. Thus, the Department is engaged in a never-ending study of all metallic and nonmetallic minerals, rich and poor in quality, to ascertain whether these products can be converted for economic industrial use.

Developing New Supply Sources

Initial production by private industry at the San Manuel copper mine in Arizona in 1956 climaxed a Department of the Interior effort to develop a new source of supply of this important metal. This giant copper deposit—over a half billion tons of low-grade ore, as well as deposits of molybdenum, gold and silver—was discovered and delineated by Department geologists and engineers in an extensive investigation. A similar Department investigation resulted in the development of the Nation's only cobalt mine.

Through the work of the Department of the Interior, many submarginal deposits may become commercial mines in the future. Years often pass between discovery of deposits and initial production; so an adequate appraisal of potential resources must be a constant part of our effort to broaden our natural resource base.

Cooperative Effort

The Department of the Interior has long recognized the importance of developing additional sources of minerals to meet our ever-growing needs, and since 1951 it has promoted the development of critical and strategic minerals through loans to private industry designed to encourage exploration for new sources of supply.

Under this program, an orderly search continues to develop new reserves of raw materials needed to replace supplies which are being rapidly exhausted. The Department, upon approval by its geologists and engineers, supplies a share of the cost of new exploratory work. Repayment of these loans is provided by royalties which are based on the net value of production derived from the newly discovered properties.

While this program was developed during the Korean emergency, the Department recognizes its importance and is recommending new

legislation so cooperation between industry and Government can be maintained in the continuing development of essential mineral sources.

Minerals Exploration

Since 1879, the Department of the Interior has had responsibility for providing geologic data necessary for the discovery and orderly development of our mineral and mineral fuels resources. Geologic mapping, basic to all geologic investigations, is being done at a rate of 40,000 square miles per year, but the need for such data outstrips even this rate of progress.

Other geologic research programs in the Department contributing to the development of mineral resources include (1) appraisal of known and potential deposits in mineral-bearing districts; (2) investigation of areas geologically favorable to the occurrence of useful deposits; (3) coordinated long-term field and laboratory research on geologic processes related to the concentration of mineral deposits; (4) research in mineralogy, petrology, geophysics and geochemistry, and the practical application of these skills in seeking new resources; (5) upon occasion, physical exploration to test geologic concepts developed during research investigations and to gather useful data on occurrence, form and size of some types of mineral deposits.

Mining Research

Fundamental mining studies concerning metals and solid fuels also contribute to the broadening of our resources base. Such studies involve the inseparable factors of safety, economy, and efficiency.

A decade ago, for example, the Department of the Interior began the promotion of roof-bolting as a safety measure to curb roof-fall accidents. Since then, it has become evident that this method of roof support also cuts mining costs and increases recovery efficiency.

In bituminous-coal fields, the Department is studying the use of a modified long-wall mining method which, under some conditions, has significantly increased productivity and recovery. Current anthracite-mining research may result in the development of a continuous mining machine which can be used effectively. Additional emphasis also is being placed on the hydraulic mining, transporting, and hoisting of coal, the completion of a roof-control system for mechanized longwall operations, and the development of a rock planer which will be suitable for mining coal and other minerals.

New Metallurgical Contributions

The Department of the Interior has provided the major leadership in many fields of metallurgical research.

Most recently, the Department developed a process for upgrading high-iron bauxite—as part of the continuing program to utilize low-grade ores—which has been incorporated into a commercial production plant now under construction. Private production of titanium and zirconium now is underway in the United States, using processes developed by the Department's Bureau of Mines.

An extensive search is underway for commercially feasible methods of treating our extensive deposits of low-grade manganese ores.

Synthetic Minerals Development

The Department is now engaged also in a quest for synthetic minerals. In this new venture, progress would strengthen the Nation's resource base and simultaneously lessen our dependence upon sources beyond our shores.

Experiments in producing synthetic minerals, although spurred by immediate defense requirements, have long-range economic significance. The Department's efforts to produce synthetic mica and asbestos, for example, could lead to a secure abundant supply of these materials.

Solid Fuels Progress

In solid fuels, the Department of the Interior conducts a broad research program to strengthen the Nation's fuel resources. This research embraces the whole range of fuels from anthracite through bituminous and lignite, for chemical production as well as energy utilization. Technoeconomic studies also are conducted to facilitate the expansion of the coal industry to meet rising future requirements.

Many of the Department's scientific studies have resulted in new solid-fuels techniques such as development of more efficient coal-preparation methods, making it possible to obtain a satisfactory product from raw coal which is laden with impurities. Particularly significant also is progress to which the Department has contributed in making formerly unsuitable coals and blends usable for coke-making.

To broaden our resource base further, the Department is developing techniques for upgrading and utilizing subbituminous coal and lignites of the West. Gasification of anthracite is also being emphasized to increase the usefulness of this product.

Developing the Nation's Oil and Gas

Petroleum and natural gas are indispensable to our economy and will remain a vital energy source for many decades to come. Develop-

ment of these fuels has been of continuing concern to the Department of the Interior.

The Department estimates that about 300 billion barrels of oil and a correspondingly large volume of natural gas will ultimately be produced in the United States. In line with past history, new discoveries of reserves and new techniques for more efficient recovery will prompt upward revisions.

As a landlord, the Department controls wide areas of the public domain on which deposits of gas and oil have been and will continue to be discovered. On the outer Continental Shelf, the Department also holds stewardship over vast reserves of gas and oil. Through the years, policies to effectuate the leasing and development of oil on public lands have been in force, and more recently, the Department has moved into the field of leasing offshore drilling rights. It is the continuing interest of the Department of the Interior to encourage efficient recovery methods and conservation practices of these energy reserves within the public domain.

The Department is also the custodian of vast deposits of oil shale. The tremendous resources of liquid fuels locked in oil shale far exceed the total potential of liquid petroleum reserves. Much of the pioneering work involved in the recovery of oil from oil shale has been done by the scientists, geologists, engineers, and technicians of the Department.

The Department's oil and gas activities have stimulated exploration and development of oil and gas. Through the promotion of efficient production methods and effective utilization techniques, significant contributions have been made in broadening the liquid-fuels resource base of our expanding economy.

Helium Supply Problems

Developing a long-range helium program is one of the most important responsibilities of the Department of the Interior.

Demand for this inert, lightweight gas—of which the Department is the sole large-scale producer—has risen 500 percent over the past 10 years to a record peak of 300 million cubic feet annually. Federal agencies use about 75 percent of all helium produced. The remainder is utilized by private industry under Government contracts, with the exception of small but important quantities used for medical research.

Increased requirements have seriously depleted Government-owned helium reserves which, before World War II, seemed adequate for more than a century. The reserves have shrunk to about a decade's supply at present rates of consumption. Helium-bearing natural

gas is being produced in greater quantities, but the helium is being lost because the gas is burned without having passed through a helium-processing plant.

With other Federal agencies, the Department of the Interior is giving serious attention to developing a long-range program for the conservation of our helium resources. In 1957, the first step toward improving the Nation's helium position was accomplished when the Department's Bureau of Mines initiated recovery of helium from privately owned natural gas at its Exell, Tex., plant. Continuing efforts should enable both Government and industry to enjoy the fullest possible technical advantages obtainable from our helium resources.

Topographic Mapping

Topographic maps are important basic tools in resources development, and completing and maintaining the national topographic map series is a major activity of the Department of the Interior.

Such fundamental mapping not only meets needs of the military services but supports civil requirements as well, including resources development. It provides the accurate terrain information so essential to an inventory and evaluation of both mineral and water resources. It also serves in the development of these resources through mining and the construction of water-supply, irrigation, and hydroelectric projects and for the development of other resources such as soils and forests.

Safety and Health Activities

Developing safeguards against the hazards, natural and manmade, which beset workmen in mineral industries has been a major responsibility of the Bureau of Mines of the Department of the Interior for many years.

Federal and State inspections, protective devices, proper clothing, and mandatory safety requirements help to promote safety in mineral industries. The Department, in addition, has promoted accident-prevention training as a most potent weapon against occupational hazards in the minerals industry.

Our Nation's resource base is a composite of human and physical elements, and no civilization—regardless of nature's endowments—can progress without healthy skilled manpower. While the safeguarding of manpower is basically humanitarian, tangible returns in the form of increased efficiency and better health add to the more effective utilization and development of our natural resources.

WATER RESOURCES DEVELOPMENT

Water, like the air we breathe, is essential to the survival of all life. Without adequate supplies of water, our factories would grind to a halt, and our fertile fields would turn into barren Saharas. Our civilization depends upon water, and modern-day uses of water touch almost every phase of human activity.

The Department of the Interior has vital responsibilities for the development and conservation of the Nation's water resources, and it administers many programs in an effort to guarantee an adequate supply of water for present and future generations.

Water Demand to Double by 1975

Three basic factors in our expanding national economy emphasize the need for increased water resources development in future years.

Greater use by home and farm and industry is increasing water consumption from an approximate 250 billion gallons daily to an estimated 450 billion gallons per day in 1975.

Population projections show that the country will arrive at a population level of 220 million as early as 1975. If the present rate continues, we may expect that the population will double again in the second half of the century as it did in the first half. The increased demand for water by such an expanding population is self-evident.

Despite present crop surpluses, increased water demand for irrigation use is certain in the near future. Nearly 11¼ million acres of good farmland are lost each year to such things as housing developments, airports, factories, highways, and shopping centers. By 1975 more than 20 million acres of present farmland will be out of agricultural production, and during the same period, our population will have been increased by nearly 60 million people. Long-range planning for an orderly process of resource development is necessary, not only to maintain, but to increase the food supply from our dwindling farm acreage.

Partnership Responsibility

Cooperation and coordination at Federal, State, and local levels in planning the development of our natural resources is of tremendous importance to the Nation. Greatly increased water demands for municipal, industrial, domestic and agricultural purposes is a matter of immediate concern.

Continued rapid growth in population in the United States presages even greater water resources development to supply future economic

demands. This is particularly true in the West, where population and industry are expanding more rapidly than elsewhere in the Nation, despite the additional problems posed by an average precipitation which is considerably lower than elsewhere in the United States.

These and other factors in present-day multipurpose water resources development are opening a new era in national economics. To meet this coming challenge, our river water must be utilized to the fullest possible extent before it is permitted to flow into the sea.

This objective can be best attained by cooperative arrangements between Federal, State, and local governments, private industry, associations, and individual citizens in the planning, construction, and operation of water-use facilities.

Irrigation Progress

In 1847 the Mormons undertook the first irrigation of land in the United States. From that beginning, irrigation spread throughout the Western States, and by 1900 about 7½ million acres of land had been placed under irrigation, largely by private initiative and financing.

By that time, the most simple low-cost systems of water diversion and distribution had been built. The growing need of financial and technical aid for further developments in the West culminated in the enactment by Congress and approval by President Theodore Roosevelt of the Reclamation Act of 1902 under which, as amended and supplemented, the water resources development program of the Department of the Interior operates today.

Today, more than 27 million acres of land are under irrigated cultivation in the Western States, and approximately 7 million acres, about one-fourth of the total irrigated area, receive water from facilities constructed by the Department's Bureau of Reclamation.

Multiple-Use Policies Promote Efficiency

A most significant evolution in the growth and development of the West has been the transition from the simple, single-purpose irrigation project to the planned multiple-use projects now used to fully develop available water resources.

Hoover Dam on the Colorado River not only assured a water supply for the great metropolitan area of southern California; it also provided power, irrigation and recreation facilities. The Salt Lake Metropolitan District has contracted for a large share of the water from the multipurpose Provo River project in Utah, and several municipalities in California and in the Great Plains States are receiving many direct benefits from the storage provided in reclamation reser-

voirs. These municipal and industrial water users repay the Government in full, plus interest, for the Federal investment in their behalf.

Where irrigation was once the only consideration, today's multipurpose natural resources developments also provide outstanding benefits in flood control, power, recreation, industrial, and domestic consumption.

Reclamation reservoirs are used to impound spring snowmelt and rain runoff which would otherwise go unused and cause millions of dollars worth of life and property damage. Hydroelectric power development at multipurpose dams contributes to the energy supply of growing areas. More than 10 million pleasure seekers annually visit the water playgrounds provided by reclamation reservoirs in the West. In many instances, fish and wildlife values are increased by reservoir development.

Irrigation Alleviates Drought

In 1956, when great areas of the West were suffering from an unusually severe drought, the stabilizing influence of irrigation was plainly evident. Irrigated farms constituted the backbone of production even though their own water deliveries were sharply restricted.

The Rio Grande project, for example, delivered less than 1 acre-foot of water per acre, whereas the normal requirement is nearly 3 acre-feet. This small amount, however, was enough to stave off total disaster. Irrigation also made a major contribution to the efforts to save basic breeding herds by sustaining nearly one million head of cattle and a quarter-million head of sheep.

New Projects Under Way

To encourage planning for development of additional reclamation projects, in step with the future economic needs of the Nation, is one of the most important tasks confronting the Department of the Interior.

Projected construction schedules provide for a multiple-purpose water development program which will impound 58,000,000 acre-feet of our unused water resources—enough to supply the irrigation requirements of more than 1½ million acres of land.

The Colorado River storage project, upon which construction has already begun, is a \$760 million development, the largest single reclamation project ever to be approved by the Congress.

Preliminary studies are nearly complete for the development of the Garrison diversion unit of the Missouri River Basin project. This plan contemplates a 60-year construction schedule for conveying water from existing Garrison Reservoir on the Missouri River to more than 1 million acres of land in North and South Dakota.

Completion of construction work on the Trinity division of the Central Valley project in California will make available an additional 1,190,000 acre-feet of water for presently irrigated lands. A comprehensive analysis of the Texas water needs and a broad program to meet them is two-thirds complete. Based on this study, fully coordinated water-supply and flood-control projects will be developed.

As administrator of the Small Reclamation Projects Act of 1956, the Department of the Interior processes loans and grants to irrigation districts, public agencies, and the States for the construction of projects similar to those of the regular Federal reclamation program.

Experimental Programs

Experiments are being conducted to develop a practical and economical "chemical shield" to reduce evaporation from lakes and reservoirs. Western reservoirs lose between 3 and 8 feet of surface water each year through evaporation, and laboratory studies indicate it may be possible to save up to 65 percent of evaporated water with a chemical surface coating without harmfully affecting aquatic life. Considering the hundreds of thousands of acres of water surface area in this country, the water savings could be tremendous since the successful use of such a film could have the same result as doubling reservoir capacity.

Salt cedars and other water-using scrub vegetation, which cost the American irrigation farmer an estimated \$25½ million loss each year, also are subjects of special weed control and eradication studies.

Loss of water through seepage is another problem currently under attack by experiments for the development of low-cost canal linings. Private business concerns, donating time, equipment, and materials, have rendered valuable cooperation in this research program. Thus far, the research has resulted in several million dollars in water savings on Federal reclamation projects alone.

In the last analysis, wise development of America's water resources will require planning, teamwork, and continued progress in the field of conservation and reclamation to assure adequate supplies of this important commodity to the ultimate consumers—the farmers, industries, and cities—who are dependent upon its supply.

Converting Saline Water

One answer to the growing problem of adequate water supplies is the development of new sources. A practically inexhaustible new source exists in the waters of the oceans. Additional great supplies could be provided by the saline waters of inland areas. The problem is to extract fresh water from the salt water sources at a cost low enough to make possible large-scale use.

Processes are now under development which appear economically promising. These include: Multiple-effect evaporation, vapor-compression distillation, flash distillation, solar distillation, separation by freezing, and several membrane processes.

Process development is carried out by both private and governmental organizations having interest in saline water conversion. The Department is working with the Atomic Energy Commission to determine possible ways in which improved conversion processes can be combined with the generation of atomic energy to offer an overall economic advantage.

As the cost of converting saline water is reduced through research and development, the demand for and the use of converted saline waters will increase rapidly. In the United States, the initial use of additional converted sea water will probably be industrial, and as the costs are reduced, some municipal uses and selected agricultural uses should occur, especially as a supplement to existing supplies.

Power in the Southwest

The Southwestern Power Administration operates an extensive high-voltage electric power transmission system which interconnects Federal hydroelectric powerplants and provides for the integration of Federal and non-Federal power systems in the area. It markets electric power from the Federal transmission system and also through transmission capacity of non-Federal agencies which is made available under contractual arrangements. Power generated at flood-control projects of the Corps of Engineers, Department of the Army, is thereby integrated with power from non-Federal systems to secure an economical and reliable source of electric energy for customers of the Government throughout States in the central Southwest.

In the interest of conservation of our natural resources, comprehensive planning is performed in connection with hydroelectric generation and other purposes for proper coordination in use of water stored in the several Federal reservoirs.

Power in the Southeast

Southeastern Power Administration contributes to comprehensive water resource development programs in the 10 Southeastern States primarily through the marketing of hydroelectric power and energy produced at projects operated by the Corps of Engineers, Department of the Army.

Southeastern Power Administration's power marketing program provides for the generation and integration of power produced from flood-control projects of the Corps of Engineers through contractual

arrangements which best meet the needs in the area and provide the most economical power supply. Full consideration is given to the characteristics and location of all power-generating facilities in the area and the regional power requirements.

The Federal projects generally are operated to produce peaking power. Energy is made available on the basis of long-range and day-to-day operational studies showing the most efficient use of available water, and power is dispatched on this basis in accordance with the needs of the power systems into which such power is delivered.

In furtherance of the optimum use of all resources, the Administration contributes to the planning and operational phases of river basin developments with particular regard to power and its coordination with other uses.

Power in the Pacific Northwest

The primary function of the Bonneville Power Administration is to market the electric power and energy produced at hydroelectric projects operated by the Corps of Engineers, Department of the Army, and the Bureau of Reclamation.

The Pacific Northwest is a region dependent upon hydroelectric power to a greater degree than any other area in the United States of comparable size. Because of the inadequacy of the fuel supplies and the availability of a tremendous hydroelectric potential, the Pacific Northwest has developed and utilized hydroelectric power as an energy base.

This area possesses approximately 35 percent of the hydroelectric potential of the United States and approximately 90 percent of the electric energy produced there comes from falling water.

Not only does the Northwest depend upon water for most of its electric energy but it utilizes a far greater proportion of electric power in its energy base than any other part of the United States. In the Northwest electric power supplies almost 30 percent of the total energy used in manufacturing compared to slightly less than 5 percent for the entire Nation.

The Bonneville Power Administration provides the means of marketing the electric energy developed at Federal hydroelectric projects in the Columbia River Basin. The Bonneville transmission grid with approximately 7,500 circuit miles of line forms the main high-voltage transmission system for the Northwest region. This transmission system distributes the power generated at Federal hydroelectric projects to industries, cooperatives, public utility districts, and private utilities. In addition it provides the interconnections which form the Northwest Power Pool—a voluntary organization of 11 public and private utilities serving Utah, Montana, Idaho,

Oregon, Washington, and British Columbia, covering an area of approximately 700,000 square miles.

The Northwest Power Pool integrates these 11 utilities to make the most effective use of the water resources available. One of the most important contributions of the Northwest Power Pool to resource development is the conservation of water, made possible by the pool interconnections. With the interconnected pool, water in excess of the loads and reservoir capacity of one utility can be used to generate power to be delivered to other utilities which may store water in their own reservoirs for later use.

The ability of the transmission grid to supply electric energy to widely scattered parts of the Northwest makes it unnecessary to build standby steam-generating facilities in those areas where stream-flow conditions make hydroelectric generation inadequate for certain periods each year. This results in a reduction in the investment required for generating facilities as well as a saving of nonreplaceable energy sources such as coal, oil, and natural gas.

Water Studies

In line with the Report of the Presidential Advisory Committee on Water Resources Policy, which stresses the need for more water resources data and for accelerated programs in research and interpretation, the Department's Geological Survey scientists and engineers have increased the amount and tempo of work under way to fill these needs.

Following efforts to determine the tremendous water evaporation losses, studies are now being made on the value of monomolecular films on reservoir surfaces to act as an evaporation suppressant.

Other research teams are investigating the effect on water supplies of worthless upland vegetal cover in arid regions.

Survey investigations into recharging underground aquifers—adding water which would otherwise be wasted to subsurface storage where it can be held without evaporation loss until again brought to the surface—hold much promise for water conservation. At several points in continental United States and Alaska, researchers also are watching glacier growth (or recession) to develop techniques of interpreting the significance of glaciers in relation to available water supplies and long range trends in precipitation.

PUBLIC LANDS DEVELOPMENT

As steward of the public domain, the Department of the Interior, through its Bureau of Land Management, is responsible for managing and developing nearly 477 million acres of unreserved and un-

appropriated federally owned lands which lie principally in Alaska and the 11 Far Western States. The land itself, the minerals it harbors, and the grasses, wildlife, forests, and water it supports, constitute a large portion of our Nation's natural resources.

The pressures of increasing population, rapid advances in technology, and modern living impose an ever-growing demand upon our natural stores of raw materials, and upon the land for agricultural, industrial, recreational and urban uses. Our public lands are playing an increasingly significant part in satisfying this demand and in contributing to the continued prosperity of our Nation.

Prudent disposal and progressive development of the public lands and their inherent natural wealth, for the greatest benefit to present and future generations, is the fundamental principle which guides the Department in its stewardship of our public lands resource.

The various functional programs which are designed to achieve these objectives are as diverse and technical as are the demands on the land and its resources made by our society and our economy. These programs of comprehensive balanced resource use, development, administration, and disposal are flexible enough to permit orderly expansion or contraction as the demand for program intensity fluctuates.

Development Encouraged

It is essential that development of this great landwealth be a co-operative undertaking and the Department encourages development of the public domain and its resources by State and local governments, by individuals, and by groups of citizens.

Where certain resources, such as minerals, are essential to the Nation's welfare, the Department retains regulatory control over their development and use to guard against waste and depletion. Where other Federal programs can more economically develop the greatest potential of these lands in the best national interest, they are withdrawn and reserved for management by other bureaus of the Department of the Interior and the Federal Government.

While the public lands remain under the control of the Bureau of Land Management, a comprehensive program of conservation, protection, development, and management operates to increase their productivity and enhance their economic value.

Cadastral Surveys

Accurate identification of land areas by location and delimiting boundaries is essential to the orderly and effective management of land and the development of associated natural resources. Cadastral

survey operations of the Bureau of Land Management create, re-establish, and identify the public land boundaries, dividing the land into manageable economic units.

Surveys have been extended over large areas of the public domain to permit orderly exploration, location and development of oil, gas, uranium, gold, silver, lead and other mineral resources. Work on leasing maps and the identification of coast lines to facilitate the development of petroleum reserves which underlie the submerged outer Continental Shelf lands of the United States also has assumed a prominent role in the cadastral survey program. The location of the boundaries of the Federal rangelands, a major portion of the public domain in the United States, also is essential to the development of their forage, water, and soils.

Land—the Fundamental Resource

Through a system of field investigation, Federal lands and their natural resources are examined and evaluated to determine their use potential, and public-land laws and mining and mineral leasing laws provide the framework through which the Department identifies the highest use potential of the public domain.

Classification standards determine whether the public lands will be opened to disposal under the nonmineral public land laws. Laws authorizing land disposal are designed to encourage development of the land and its resources by states or by private ownership. The authority to classify lands for retention in Federal ownership forms the primary basis under which the Government develops the material wealth of lands to be retained, insures their use for the benefit of the national economy, and prevents deterioration and waste in the interest of future generations.

The maintenance of records which accurately reflect the history, status, and use of lands and resources is requisite to the orderly development of the public domain. The Department maintains the basic land records, which date to the origin of the United States and are the legal title source for more than 1,800,000,000 acres of private and publicly owned lands. Deterioration from age and increased use have required the revision of records and recording techniques to meet present-day requirements and to insure their permanent preservation.

Rangeland Development

Techniques and practices to develop the forage-producing capacity of the public rangelands include brush removal, reseeding, moisture-retaining soil treatment and conservative grazing use. A 20-year

conservation program is now being carried out to reduce soil erosion and prevent the unnecessary loss of moisture from the public lands, thereby increasing the carrying capacity of some 170 million acres of western rangeland for livestock grazing and also to support substantial wildlife. By 1975, depleted vegetation should be restored, and soil and water losses from flood and erosion should be greatly reduced.

Progress is being made in the development of basic livestock operation records and in reappraising the qualifications of range users for grazing privileges. Several new range resource surveys have been activated, in the areas of greatest urgency, to develop basic management planning data. A program of range condition, trend, and utilization studies has been established in each State and is being emphasized in all grazing districts. Such studies provide an evaluation of the range resource and form a guide to proper range use.

Managed Forests

The primary objective of the Department of the Interior with respect to the public-domain forests is to assure their development and use for maximum benefit to the Nation.

The forest areas of unreserved public domain in the United States under the jurisdiction of the Bureau of Land Management aggregate nearly 34 million acres; 4 million of these carry commercial-value classification. The remaining 30 million, classed as woodlands, provide a local supply of fuel wood, posts, poles, and other products, and constitute a large reserve of wood source for potential commercial development.

Forest lands administered by the Bureau of Land Management fall into three categories: the revested Oregon and California Railroad Grant Lands and other lands in western Oregon, generally identified as the O. and C. lands; the public domain commercial forest and woodlands in the continental United States; and the public domain forests and woodlands of Alaska.

The O. and C. lands of western Oregon are destined by law for permanent Federal development and management. They comprise nearly 2 million acres which are now producing or capable of producing a large volume of high-value timber. Their development and perpetual management for the production of trees and wood and fiber, for the greatest economic and social good to the Nation, is the primary objective of the Bureau in its program for these lands.

Forty million acres of commercial and 85 million acres of non-commercial forest under the Department's administration in Alaska constitute an enormous forest reservoir of potential pulp and paper supply. Present efforts of the Department are devoted largely to

protection of these forests from fire. The initial steps of a plan for forest inventory have been completed, and data supplied by the inventory will furnish the basis for plans designed to manage these forests, to develop their economic potential, and to supplement domestic wood supplies.

Mineral Exploration on Public Lands

The Department of the Interior administers Federal mining and mineral leasing laws on approximately 800 million acres of land—more than one-third of the total land area of the United States and Alaska.

As agent for the Department, the Bureau of Land Management encourages development and production of the various minerals from the public domain by private enterprise. The primary program objectives are to promote expeditious exploration of the land for the discovery of mineral deposits and to insure their sound development and wise use, thus conserving and extending the supply of mineral resources.

FISH AND WILDLIFE RESOURCES

America's fish and wildlife resources, unlike its mineral resources, are living and renewable. They must be continually developed to provide for regulated annual harvesting by hunters, trappers, and sports and commercial fishermen.

The Federal Government has definite responsibilities for sustaining and augmenting these resources, and the Department of the Interior, through the U. S. Fish and Wildlife Service, is planning a comprehensive development program with the realistic objective of adequately meeting the demands which a growing America will place upon fish and wildlife.

The great interest of the people of this country in hunting and fishing was underlined by a recent nationwide survey which showed that 25 million people 12 years of age and over hunted or fished in 1955.

The Survival of Waterfowl

The future of waterfowl on the North American Continent is a matter of concern to thoughtful conservationists, as the needs of waterfowl are in ever-growing competition with a rapidly expanding human population. Natural marshes of the gulf coast and the Pacific Flyway are being seriously damaged for waterfowl use.

Waterfowl face a precarious future. Major reliance for their survival will have to be on the lands developed for their needs, whether

in the ownership of the Federal Government, the States, or private citizens.

Since the Nation's fast-diminishing wetlands are especially vital to waterfowl, special attention was given during the past year to wetland development. Progress was made in retarding drainage and other activities destructive of wetlands, but increased effort is necessary if satisfactory wetlands are to be preserved.

Wildlife Research

An increasing number of hunters are making greater demands on wildlife resources and, to meet the growing demand, the Department of the Interior is developing, through research, methods of utilizing marginal or nonproductive areas and increasing the productivity of existing marshes. Attention also is being given to the development of wildlife management techniques which can be incorporated into farming operations for maximum wildlife production. Timber-stand improvement projects and other forest-management activities are being carefully evaluated to determine their effects on wildlife. Increased study is being devoted to the rapidly growing use of pesticides which, because of their harmful effects on fish and animals, pose a grave problem in the field of fish and wildlife management.

Restoration Programs

Through cooperative wildlife management activities, large areas of privately owned timberland and State-managed refuges are being made available for public hunting grounds. Other continuing Department activities include access-road development, habitat improvement, and fire control.

There also has been increased cooperation among the States in restocking game birds and animals and in managing the wildlife of boundary forests. Waterfowl studies, dove migration surveys, and regionwide disease investigations are being cooperatively developed.

A nationwide program of tree, shrub, and herbaceous crop planting is restoring wildlife in areas of low production. More than 5,000 acres of marsh and 6,000 acres of new fishing water in 37 lakes have been developed, and over a quarter million acres of land have been made available for wildlife and fish restoration activities. These programs are providing needed additional wildlife habitat and recreational opportunities.

Development of Commercial Fisheries

Exploratory fishing has succeeded during the past year in extending commercial fishing boundaries into deeper waters beyond the Conti-

mental Shelf. Development and practical application of newer types of fishing gear and modern electronic instrumentation have made wider utilization of fishery resources practical. For example, the first commercial landings of shrimp on the coast of Washington followed the successful search by the Department for new sources of supply.

In many instances, success in developing our commercial fishery resources requires the cooperation of foreign governments. The international fishery commissions, to which the United States belongs, employ exhaustive research and regulatory measures and seek to determine and bring into existence the conditions which will make possible the maximum sustainable yield from the fish resources with which they are concerned.

These efforts have resulted in increasing catches in the Pacific halibut, Frazer River sockeye salmon, and New England trawl fisheries; an understanding of the basic dynamics of the tuna resources of the eastern tropical Pacific Ocean and substantial progress toward a determination of the potential maximum yield from these resources; significant discoveries regarding the migration and distribution of the North Pacific salmon; and major advances in the control of the predatory lamprey in the Great Lakes.

Maintaining the Inland Fisheries

Responsibility for the maintenance of the inland fisheries rests with the States and the Department of the Interior, which restocks waters and manages the game-fish resources on Federal areas or on water-use projects in cooperation with the States. Assistance to the States is rendered wherever possible in research, management of waters, and fish rearing.

In a long-range plan for wise development of fish and wildlife resources, existing Federal fish hatcheries will be modernized and rearing facilities expanded to build up fish stocks on federally controlled areas and to supplement State programs. Several new Federal hatcheries will be built in areas where large water-use projects are developing fish requirements in excess of the production potential of State units.

Developing the Fisheries of Alaska

In 1954, after two decades of substantial decline in the annual yield of the salmon fisheries in Alaska, the Department of the Interior inaugurated an aggressive development program which drastically reduced fishing effort and vigorously enforced fishery laws and regulations. This action was supplemented by a sixfold increase in fishery

research in Alaska. The results of the program are encouraging. Spawning streams were well seeded in most areas in 1956, and the salmon pack increased more than 25 percent over 1955 levels.

A system of fishing gear registration was instituted in 1956 to reduce fishing intensity, while other regulations were issued to prohibit salmon fishing, other than trolling, on the high seas in waters contiguous to Alaska under the authority of the North Pacific Fisheries Act of 1954. This action prevented the establishment of a high seas fishery which would have jeopardized the Department's program for Alaska proper.

Fishery Biological Research

Many new devices are being developed to protect our fisheries. Some of these new tools for resource research and management are designed to control the movements of fish to guide them into safe passage at dams and diversions, to control predatory fish, and to control or eliminate the invasion of unwanted or undesirable species into reservoirs or water systems. As research progresses, the large-scale salt water pond cultivation of shrimp, oysters, and clams—all valuable and nutritious food—approaches practicability.

The immediate future holds some challenging opportunities for broadening the base of knowledge upon which our fishery resources may be further developed to meet the growing needs of our people.

INDIAN RESOURCES

The Department of the Interior functions as trustee over Indian lands and resources, which are essentially private property, owned either by individual Indians or tribal organizations. In the development and management of these resources, the interests of the Indian owners, long-range as well as immediate, are given first priority over any other consideration.

During the past 3 years, the Department, through the Bureau of Indian Affairs, has placed increasing emphasis on resource development as an important and effective way of improving the economic status of the Indian people. This program has encouraged a broadening Indian participation in the formulation and execution of resource development programs on the individual reservations.

Developing Indian Oil and Gas Resources

The most dramatic financial result of Indian resource-development programs in recent years has been in the leasing of Indian lands for oil and gas recovery. Over the 5-year span from fiscal 1952 through

fiscal 1957, the combined area of Indian lands under oil and gas leases increased from 2,021,822 acres to 5,835,856 acres, and the Indian income from these leases soared to \$19,181,053 to \$72,616,644.

Many tribes in various parts of the country are now benefiting from oil-exploration operations. In 1949, the first well on the Uintah and Ouray Reservation in Utah was brought in. Discovery of oil in 1951 in the Williston Basin covering considerable Indian land in Montana and the Dakotas set off another large development program. Recent discovery of gas and oil in the "four corners" area of Arizona, Colorado, New Mexico, and Utah is steadily increasing the incomes of tribes in that area.

Construction of additional pipelines to California has resulted in oil and gas development on the Navaho, Jicarilla, Southern Ute, and Ute Mountain Reservations. Discovery of new pay formations in partially developed areas, shallow drilling depth to production, and water-flood projects have brought favorable results on the Osage Reservation in Oklahoma. In 1956, for example, the Osage Tribe received a total bonus of almost \$10 million, compared to less than \$7 million for the 5 previous years combined.

Other Indian Mineral Resources

The development of other mineral resources on Indian lands has been steadily progressing. From 1952 through 1956, the area under lease for such development increased from 50,385 acres to 197,673. Indian income under these programs has risen from \$1,671,797 to \$2,881,533. Although there is less uranium exploration than in previous years, this activity is still outstanding in economic importance. Asbestos, coal, iron, sand and gravel, phosphate, lead, and zinc are also being developed.

Forest Resources

Developing the forest resource base on Indian lands includes three principal activities. First, more complete information on timber resources is being obtained through new inventories and a redetermination of growth potential. Secondly, closer utilization and reduction of waste are being accomplished by changes in timber-sale methods. Finally, improved methods of protection against fire, insects, and disease are being developed.

The awakening public interest in resource development is reflected in increased appropriations for management of all forests under Federal supervision, including Indian lands. Some tribes also have increased the amount of tribal funds earmarked for forest management and protection. One result is an increasing number of reservations for which urgently needed forest inventories have been obtained. With

these inventories, the allowable annual cut under sustained-yield management is anticipated, and efforts are being made to bring the annual harvest up to the allowable maximum.

Agricultural Lands

Since the 1880's, more than 170 irrigation systems have been developed on Indian reservations in the western states, irrigating 870,000 acres of land. These projects vary in size from a few acres to more than 120,000 acres. Three electric power generating distribution projects have been authorized and constructed in connection with irrigation projects on Indian lands. Water storage reservoirs now have a capacity of 2 million acre-feet, and in addition, supplemental water is provided by storage in reclamation reservoirs for about 200,000 acres of Indian lands.

Through soil and moisture conservation programs, guidance and assistance are provided for the Indians in development of land according to its needs, its uses, and its capabilities. Indian-owned rangelands support approximately 975,000 cattle units of livestock with an annual value of over \$6 million. Substantial income also is produced on these lands in the wildlife, scenic, and recreational areas. A good portion of the income provided by these sources is being reinvested in water conservation, reseeding, and other resource development projects.

Objectives of Indian Programs

The Department has trust responsibility for more than 39 million acres of tribal lands and 14 million acres of allotted Indian lands.

While these Indian assets are held in trust, it is the aim of the Department to assist the Indians in obtaining maximum return from the use and development of their resources consistent with good management and conservation concepts; to preserve the renewable resources in a perpetually productive state; and to renew the productivity of those resources which have deteriorated.

Although management of these lands is still a Federal responsibility, the Department encourages the Indians to prepare for eventual assumption of full responsibility and authority.

TERRITORIAL RESOURCE DEVELOPMENT

The Department of the Interior is responsible for the development of the natural resources of the 3,160,000 people who reside in Alaska, Hawaii, the Virgin Islands, Puerto Rico, Guam, American Samoa, and the trust territory of the Pacific Islands.

To promote the effective and prudent development of the natural resource base of America's Territories and trust possessions, the Department, through the Office of Territories, fosters a climate of self-government which is essential to the current welfare and future prosperity of territorial populations.

The Territories, particularly Alaska, constitute a major portion of the undeveloped natural resources of our Nation, and the efforts of the Department in developing these new resources fall into many categories.

Departmental Interests Varied

The jurisdiction over the development, use, and conservation of territorial natural resources is not confined to a single office of the Department, and many bureaus are concerned with broadening the resource base of the Territories.

The Bureau of Land Management is responsible for the administration and development of nearly 500 million acres of land, about three-quarters of which lies in Alaska.

The Bureau of Mines conducts research and development programs important to the development of Territorial mineral resources, and the Bureau of Reclamation is concerned with hydroelectric generating potential and water conservation practices in the various territories.

The Fish and Wildlife Service is responsible for the development and administration of fishing regulations, fishery research programs, and wildlife conservation in the territories.

The Geological Survey devotes a substantial portion of its activities to the mineral, fuel, and water resources of Alaska and the other Territories. Mineral geology and water resources in Guam are receiving attention, and the water well sites on American Samoa are being located by the Survey.

Hawaii and the Trust Territories

Hawaii possesses great wealth in lush agricultural land, in scenery, and in climate. For the most part, these natural resources have been developed wisely, and further plans call for continued broadening of the Hawaiian resource base through such activities as the Waimea and Molokai irrigation projects.

In the Trust Territory of the Pacific Islands, the Department of the Interior is responsible for the development of the air and water transportation systems which are absolutely vital to the advancement of the islands' economic life, but are not as yet attractive to private enterprise. Furthermore, the land resources of these areas,

of Guam, and of American Samoa are so meager that the Federal Government has a special responsibility to protect and develop them.

The Wealth of Alaska

The story of the development of the natural resources of the Territories inevitably centers on the vast land and water areas of Alaska. It is many times larger than the rest of the territorial areas of the United States; moreover, Alaska contains great reserves of undeveloped natural resources.

In Alaska only the commercial fisheries and certain mineral operations, such as gold mining, have been extensively developed. The vast coastal forests are in the initial stages of utilization, and the search for oil and gas is still in the exploratory and discovery stage. Currently, the development of many important resources in Alaska is not yet economically feasible because of poor transportation or market location.

Expanding the Resource Base

In Alaska's resource development, exclusive emphasis is no longer placed on the standbys of fur, fish, and certain minerals. Other sources of natural wealth are being developed to give more stability, diversity, and permanency to Alaska's economic base.

An important beginning has been made in this direction by the large-scale utilization of the forest and agricultural resources of the Matanuska, Kenai, and Tanana Valleys. Increased oil exploration and the initial development of some of the Territory's immense hydroelectric resources also are contributing to the rapid growth of a prosperous Alaska.

Alaskan Minerals and Forests

While favorable petroleum structures have been located in various parts of Alaska, drilling has not yet brought in fields of major importance. Vast areas are under lease, however, and extensive exploration is being conducted. The U. S. Navy has discovered large reserves in northern Alaska, and the Department has received many requests that these lands be opened for mineral and mining exploration and development.

The first large-scale development of Alaskan timber resources began in 1954 with the opening of a \$50 million pulp mill near Ketchikan. Plans have now been initiated for the development of additional pulp mills at Sitka, Juneau, and Wrangell. The proposed

Sitka mill, sponsored by Japanese interests, is supported also by American capital.

There has been increased interest in mineral development during the past year in the Klukwan iron-ore deposits, north of Haines, and the Department is sponsoring legislation which will make possible the leasing of these lands for development.

THE NATIONAL PARK SYSTEM

The congressional mandate, which established the National Park Service as a constituent bureau of the Department of the Interior 41 years ago, directed the Department "to conserve the scenery and the natural and historical objects and wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

The spectacular rise in visits to the national park areas demonstrates the enjoyment the American people derive from this priceless heritage. Park visitors in calendar year 1956 totaled nearly 55 million, up 10 percent over the preceding year and more than 150 percent above the 1946 figures. In the first 6 months of 1957, park visitors totaled 23,302,520, as against a total of 21,338,076 for the same period in 1956, indicating that attendance for the full year will approach the 60 million mark.

Unlike resources which yield material things, the parks provide such precious cultural and inspirational intangibles as knowledge of nature, spiritual refreshment, and wholesome recreational opportunity. Intelligently managed and used, these resources can be drawn upon almost endlessly without depletion, but if destroyed by misuse they are lost forever.

Mission 66

The past fiscal year provided tangible evidence of the benefits in store for this and future generations under the Mission 66 program of park development which was inaugurated on July 1, 1956.

Mission 66 is designed to develop the irreplaceable natural, scientific, and historic resources entrusted to the care of the Department of the Interior for the enjoyment and inspiration of millions of Americans. At the same time, the accumulated inadequacies and abuses of past years will be eliminated.

In its first year, Mission 66 has made dramatic progress toward providing the facilities and services required to cope with the rising tide of visitors. More than 650 park improvement projects had been programed and 113 completed by the end of the fiscal year.

When its goals are reached in 1966—the golden anniversary of the establishment of the National Park Service—Mission 66 will provide the American people with a national park system properly developed and adequately staffed to keep abreast of the increasing interest of our people in the great outdoors and in our historic and prehistoric past.

First Year Developments

Among the facilities placed in operation in the past year were: seven new visitor centers and major addition to four others; 83 new wayside interpretive installations to provide better understanding of the parks; new and improved campsites with facilities for some 8,000 additional campers daily; 56 new comfort stations; parking facilities for an additional 7,500 automobiles; and 51 new or improved water systems. Some 185 miles of run-down park roads are undergoing reconstruction and improvement and 39 miles of new roads were completed.

In addition, private enterprise invested some \$7,200,000 during the year to expand overnight accommodations, restaurants, stores and other public service installations in the parks, resulting in accommodations for an additional 2,500 visitors.

Diminishing Recreational Resources

The supply of open spaces suitable for recreational development is rapidly vanishing. How rapidly was demonstrated in the National Park Service report, *Our Vanishing Shoreline*, issued in July 1956. This report summarized findings of a survey of the Atlantic and gulf coasts with this statement:

“Almost every attractive seashore area on our Atlantic and gulf coasts has been preempted for commercial or private development. Only a fraction of our long seacoast is left for public use and much of this small portion is rapidly disappearing before our eyes.”

As the fiscal year ended, a similar survey was in progress along our Great Lakes and Pacific shoreline, and more detailed followup studies were under way along the Atlantic and gulf coasts.

Historic Areas

The great scenic areas of the national park system are augmented by the cultural contributions of the historic areas which encompass the whole range of our prehistoric, colonial, and national history.

More than 13 million Americans visited these historic shrines in 1956, strengthening their understanding of our inspiring past and

reinforcing their faith in the future of our democracy. In the first 6 months of 1957, visitation to the historic areas was running 16 percent higher than last year.

New Areas Established

On December 1, 1956, the Virgin Islands National Park on the beautiful island of St. John in the United States Virgin Islands was formally opened and dedicated as our 29th national park, and the Booker T. Washington National Monument was established near Rocky Mount, Va., on June 18, 1957.

Two new national historic sites were established during the year—the Golden Spike National Historic Site at Promontory, Utah, and Chimney Rock National Historic Site near Bayard, Nebr.

Some 52,000 acres of private holdings within the boundaries of the national parks were acquired during the year by purchase, donation, or exchange and, as the year ended, the National Park Service administered 182 areas embracing 25,100,000 acres, of which 24,421,000 were federally owned.

As the American people in the years ahead draw ever-increasing dividends of healthful recreation and patriotic inspiration from the great resources of our park system, the Department of the Interior's program of sound development will help provide the safeguards to assure that these resources will be passed along unspoiled and undiminished for the enjoyment of future generations.




PART II

ANNUAL REPORTS OF THE
BUREAUS AND OFFICES OF THE
DEPARTMENT OF THE INTERIOR

Office of the Assistant Secretary

Water and Power Development

Fred G. Aandahl, *Assistant Secretary*



THE ASSISTANT SECRETARY for Water and Power Development discharges the duties of the Secretary with respect to the Department's programs in the field of water and power development. The Assistant Secretary exercises secretarial direction and supervision over the Bureau of Reclamation, Bonneville Power Administration, Southeastern Power Administration, and Southwestern Power Administration. The principal function of the latter three agencies is to market surplus power generated in their respective areas at Federal projects. The Bureau of Reclamation constructs water-use projects whose primary purpose is the reclamation of arid and semiarid lands in the West, and also markets surplus power produced at Federal projects in the West outside the boundaries of the Bonneville Power Administration and Southwestern Power Administration and at Falcon Dam on the Rio Grande River, an international project. The Assistant Secretary for Water and Power Development is also responsible for carrying out the defense functions of the Secretary with respect to electric power and for supervising and directing the Office of Saline Water. The activities of the water and power agencies of the Department and the Office of Saline Water are more fully described in sections of this report covering each of the Department's bureaus and offices.

The table on the next page, prepared on a consolidated basis for fiscal year 1957, shows the installed capacity of plants whose power is marketed by Interior Department agencies, net energy generation, energy marketed, and gross revenues.

The Assistant Secretary for Water and Power Development participated in the negotiation of contracts for the marketing of power and integration of power systems in the operating areas of the South-

Power Production and Marketing Data, Fiscal Year Ended June 30, 1957

| Marketing agency | Installed capacity, as of June 30, 1957 (kilowatts) | Net energy generated (million kilowatt-hours) | Energy marketed (million kilowatt-hours) | Gross revenue (thousands of dollars) |
|-----------------------------------|---|---|--|--------------------------------------|
| Bureau of Reclamation | ¹ 5,808,050 | 26,261 | ⁴ 11,611 | ⁵ \$43,845 |
| Bonneville Power Administration | ^{2 3} 2,434,000 | 15,864 | 28,216 | 64,762 |
| Southeastern Power Administration | ² 1,126,000 | 2,500 | ⁶ 2,546 | 13,644 |
| Southwestern Power Administration | ² 501,000 | 1,367 | ⁶ 1,876 | 8,772 |
| Total | 9,869,050 | 45,992 | 44,249 | 131,023 |

¹ Includes 745,000 kilowatts in Corps of Engineers, 31,500 kilowatts in International Boundary and Water Commission, and 5,031,550 kilowatts in Bureau of Reclamation projects.

² Capacity in Corps of Engineers projects.

³ Bonneville Power Administration also markets power from Bureau of Reclamation Grand Coulee, Hungry Horse, and Chandler powerplants with a capacity of 2,271,000 kilowatts. (This amount included in Bureau of Reclamation installed capacity.)

⁴ Excludes 14,043 million kilowatt-hours delivered at Grand Coulee, Hungry Horse, and Chandler powerplants by Bureau of Reclamation to Bonneville Power Administration. (This amount included in Bonneville Power Administration energy marketed.)

⁵ Excludes \$16,308,000 revenue received by Bureau of Reclamation from Bonneville Power Administration. (This amount included in Bonneville Power Administration gross revenue.)

⁶ Includes purchased energy.

western Power Administration and Southeastern Power Administration. Negotiations were completed and contracts were signed with two generating and transmission cooperatives for them to meet electric powerload growth through independent expansion of the cooperatives' production and transmission facilities. Major changes in other generating and transmission contracts were negotiated to comply with the directive of Congress that power should be delivered, insofar as practicable, at a uniform rate in the Southwest. In the Southeast, negotiations were conducted to market the output of Buford, Allatoona, and Clark Hill projects under a single contract similar to the Clark Hill arrangement, which was placed in operation on June 20, 1956. Arrangements for the marketing of the output of the Jim Woodruff project power in the northern Florida area are nearing completion through a wheeling and firming arrangement involving public and private utilities in the area.

The Assistant Secretary for Water and Power Development directed the preparation of an average rate and repayment study to determine the requirement for rates for the sale of electric power in the Southwest area. Existing rate schedules that were initially approved in 1947 have been found to be deficient and will not produce repayment of Federal investment on a 50-year basis. Therefore, new proposed rate schedules were developed to produce sufficient revenue to repay costs within 50 years. On November 16, 1956, the Assistant Secretary requested the Federal Power Commission to approve and confirm these proposed rate schedules.

The Commission approved and confirmed the rates on August 9, 1957. The Assistant Secretary also directed the preparation for submission to the Senate Committee on Interior and Insular Affairs of a statement on the Missouri River Basin project, relating to the physi-

cal plan of development, water and power rates, basis of project pay-out, cost allocations, reservoir operation, and power marketing.

Progress has been made on an important power cooperation program initiated last year. Approval was given the Bonneville Power Administration to enter into long-term contracts with non-Federal generating utilities for transmission of power over the Federal transmission grid in the Northwest. This program is intended to produce more complete regional integration and secure the most economical use of resources. Bonneville Power Administration will construct feasible additional transmission facilities as needed, and reimbursement to the Government will be on a use-of-facilities basis.

During the fiscal year, the Department through the Assistant Secretary for Water and Power Development reviewed 31 reports of the Corps of Engineers, Department of the Army, primarily for flood control and navigation improvements; 38 Federal Power Commission applications for permits and licenses for hydroelectric developments; one report of the Public Health Service, Department of Health, Education, and Welfare, for water pollution control; and one proposal of the International Boundary and Water Commission for construction of control dams in the channel of the lower Rio Grande River.

The Assistant Secretary for Water and Power Development participated in the interagency study of western drought problems centering on the President's tour of the distressed area.

The Assistant Secretary served as departmental representative on the Interagency Committee on Water Resources and participated in the joint field conference of interagency committees for the Missouri and Arkansas-White-Red Basins. He also served on the President's Advisory Committee on Public Works. The Assistant Secretary conducted field conferences on power marketing, land limitation in the Columbia Basin, and irrigation development. Staff of the office served as departmental representatives on interagency committees concerned with radio frequency allocation, turbine procurement, international water developments, public works planning, coordination of water resources projects, cost allocations, financial practices for water and power projects, economic analyses, atomic energy, and allied technical subjects.

Other significant activities of the Assistant Secretary and his staff included testimony before congressional committees on the Fryingpan-Arkansas, Trinity, Missouri River Basin, other reclamation projects, land acquisition at reservoirs, and standards for water development projects; a special study of drainage problems at the Yuma project; further discussions of potential Canadian storage reservoirs; and reappraisal of irrigation benefits and price levels with the cooperation of the Department of Agriculture.

BUREAU OF RECLAMATION

Wilbur A. Dexheimer, *Commissioner*



Introduction

THE BUREAU OF RECLAMATION in 1957 fiscal year made important contributions to the Nation's resource base by teamwork with other Federal agencies and State and local government units, private industry, and citizens in the development of the water and land resources in the Western United States.

About \$130 million were converted into wealth-creating reclamation facilities available to serve the West and the Nation. Purchases from these expenditures were reflected in the flow of business in each of the 48 States.

Construction completed during the year added more than 160,000 acre-feet of storage space in new Reclamation project reservoirs, 57,000 kilowatts of hydroelectric generating capacity, 117 miles of canals, aqueducts, and related water conveyance and distribution structures, and 526 miles of large electrical transmission lines.

A notable event was the start of construction on the Colorado River Storage Project. On October 15, 1956, President Eisenhower pressed a gold key at the White House to signal the explosion of simultaneous initial blasts in the construction of Glen Canyon Dam in Arizona and Flaming Gorge Dam in Utah.

These are key structures in the project which will make possible the development of the vast Upper Colorado River Basin's irrigable lands and abundant resources of fuel, oil, minerals, and timber. Urgently needed water will also be supplied to municipalities and other benefits will be obtained from recreation, fish and wildlife conservation in the Upper Basin, and from sediment retention and river regulation for power production and flood control in the Lower Basin.

The Bureau is responsible for overall supervision of the care, operation and maintenance and replacement of facilities capable of delivering irrigation water to more than 7½ million acres of land—more

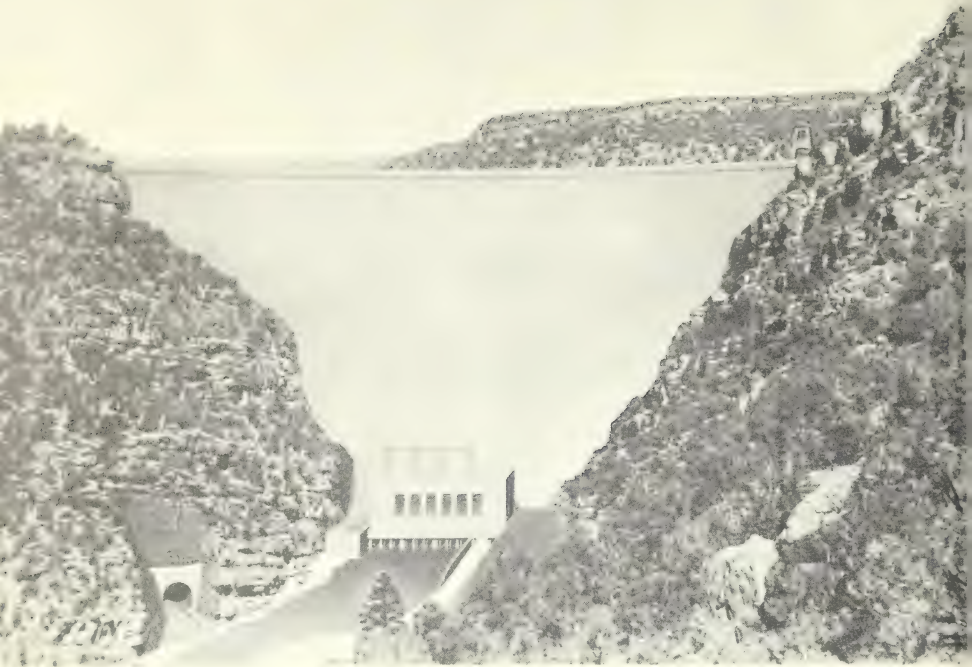


Figure 2.—Flaming Gorge Dam. An artist's conception of Flaming Gorge Dam when completed on the Green River in Utah gives an idea of the size of the key storage structures on the Colorado River Storage Project. Under the project, a total of 132,360 acres of new land in the five-State area will receive water and, in addition, 234,000 acres of land already under cultivation will receive supplemental water. More than 1 million kilowatts will be added to Upper Basin electric power capacity.

than one-fourth of the total irrigated land area of the Western United States. Most of the facilities are operated by local water users organizations which have contracted with the Government for repayment of a share of the construction costs.

This is in accordance with a longstanding policy and the Bureau of Reclamation has been diligent to transfer the responsibility for operation and maintenance of irrigation projects to the water users. With a few exceptions, the Bureau actually operates and maintains only the reserved works of multipurpose projects, while the balance of the facilities are operated and maintained by the various irrigation districts.

During fiscal year 1957, the irrigation distribution facilities serving approximately 85 percent of the total irrigable acreage included in Federal Reclamation projects were operated and maintained by the water users. Because of its investment in these projects, however, the Federal Government, through the Bureau of Reclamation, is re-

sponsible for inspection and for general supervision of operation of all of the project facilities.

The total harvest from all Reclamation projects in calendar year 1956 was valued at more than \$951.6 million, an average of \$148.69 per irrigated acre. Irrigable lands for service totaled 7,658,800 acres, of which 6,400,140 acres were actually irrigated. As compared to 1955, this represents an increase in irrigation of 138,380 acres.

Half of the area of the Reclamation West lay in the clutch of severe drought in calendar year 1956. Arizona and New Mexico, suffering from drought since 1942, experienced continued shrinking of reservoir supplies, runoff, and ground water levels. From Nebraska southward, the "grey belt" of irrigation which traditionally changes from subhumid to semiarid turned completely arid. Parts of Utah and Colorado likewise withered under almost unprecedented drought conditions.

So acute and widespread was the plight of thousands of farmers and hundreds of cities and towns that the President, accompanied by the Secretaries of Interior and Agriculture, made a special tour of the drought-stricken area in mid-January 1957. Bureau of Reclamation planning efforts were intensified following his visit and have already resulted in one project, San Angelo, Tex., being authorized by the Congress.

The stabilizing influences of irrigation have been evident throughout the drought-stricken areas. Large proportions of the immediate feed shipments into the drought areas of Texas and New Mexico originated on irrigated farms. The scattered irrigated farms constituted the backbone of production in the West although water supplies were severely restricted. The Rio Grande Project in Texas, for example, delivered less than 1 acre-foot of water per acre, whereas the normal irrigation requirement is nearly 3 acre-feet.

Nevertheless, handicapped as they were by drought, irrigation facilities in Reclamation Region Five, embracing the States of Texas, New Mexico, and Oklahoma, contributed substantially to the saving of the basic breeding herds of cattle on adjacent ranges, where irrigated farms sustained nearly one million head of cattle and more than a quarter of a million head of sheep. In addition, these farms provided sufficient feed to produce 371 million pounds of beef. Other irrigated areas in nearby States supplied grain and forage to sustain livestock herds and to carry on the regular cattle and sheep fattening enterprises.

The public acclaim and recognition of the bolstering effects which irrigation is able to produce during periods of extreme drought was manifested in the increased private ventures into well irrigation and by continued requests for Bureau assistance in solving major water supply problems in the West.

The snow pack in the Columbia River Basin this year was near normal; however, sustained high temperatures in April and May resulted in unusually high rates of flow in some areas. Operation of Bureau reservoirs in Region One—Washington, Oregon, Idaho, and western Montana—resulted in substantial reductions in downstream flows particularly on Upper Snake River and on the Boise, Payette, Owyhee, Malheur, and Flathead Rivers in Idaho. Except for Hungry Horse Reservoir in Montana and Lake Roosevelt in Washington, the Bureau's reservoirs were operated to reduce flooding in the local areas of the reservoirs. Storage in these reservoirs did, however, reduce the peak flow on the Lower Columbia River by more than 100,000 cubic feet per second and reduced the river stage at The Dalles, Oreg., approximately 2.5 feet.

Estimates indicate that in 1956, more than 12 million persons enjoyed the use of recreational facilities on the 140 principal Federal Reclamation reservoir areas in the 17 Western States. These water playgrounds are made available for public use through cooperative administration arrangements among the Bureau, the National Park Service, the United States Forest Service and State and local governmental agencies.

Guided tours were provided at Hoover Dam and Powerplant on the Boulder Canyon project in Arizona and Nevada; Shasta Dam and powerplant on the Central Valley project in California; Hungry Horse Dam and powerplant on the Hungry Horse project in Montana; Grand Coulee Dam and Powerplant on the Columbia Basin project in Washington; and Granby Pumping Plant on the Colorado Big-Thompson project in Colorado. Self-guided tours were initiated at Davis Dam and Parker Dam on the Colorado River between Arizona and Nevada and Arizona-California, respectively.

A folder "Reclamation's Recreational Opportunities," prepared in 1956 at the request of the House Interior and Insular Affairs Committee, has proved such a "best seller" that a second reprinting was necessary and is now available for sale through the Superintendent of Documents, United States Government Printing Office.

The 77 Reclamation irrigation projects, located throughout the 17 Western States, are divided into seven regions for administrative purposes. States located mainly within each region, and regional headquarters, are as follows:

Region 1.—Washington, Oregon, Idaho, and western Montana; Boise, Idaho.

Region 2.—California, except southern portion; Sacramento, Calif.

Region 3.—Arizona, southern California, and southern Nevada; Boulder City, Nev.

Region 4.—Nevada, Utah, western Colorado and southwestern Wyoming; Salt Lake City, Utah.

Region 5.—Texas, New Mexico, Oklahoma, and southern Kansas; Amarillo, Tex.

Region 6.—Eastern Montana, North Dakota, South Dakota, and northern Wyoming; Billings, Mont.

Region 7.—Eastern Colorado, Nebraska, northern Kansas, and southeastern Wyoming; Denver, Colo.

IRRIGATION AND CROP PRODUCTION

During fiscal year 1957, the Bureau of Reclamation was responsible for overall supervision of the care, operation, maintenance, and replacement of facilities capable of delivering irrigation water to more than seven and one-half million acres of land—more than one-fourth of the total irrigated land area of the Western United States.

1956 Crop Production

The total harvest from all Reclamation projects in calendar year 1956 was valued at over \$951.6 million, an average of \$148.69 per irrigated acre. Irrigable lands for service totaled 7,658,800 acres, of which 6,400,140 acres were actually irrigated. As compared to 1955, this represents an increase in irrigation of 138,380 acres.

Forage crops were produced on 46.9 percent of the net area irrigated on all Reclamation projects, and 24.3 percent of the irrigated lands were utilized in producing cereals. The crops within these two groups, totaling more than 15.4 million tons, are utilized principally as livestock feeds, generally in the local areas of production.

Over 5.9 million tons of fresh vegetables, fruits, and nuts were produced from 739,780 acres of irrigated lands. Dry miscellaneous food crops such as dry beans, sugar beets, mint, hops, etc., totaling over 6.5 million tons, were produced from almost 666,000 acres. Data on crop production by crop groups follow:

| Crop group | Irrigated crops | | Gross crop value | |
|---|-----------------|------------------|------------------|------------------|
| | Acres | Percent of total | Dollars | Percent of total |
| Cereals..... | 1,560,894 | 24.39 | 103,740,325 | 10.90 |
| Forage..... | 3,001,023 | 46.89 | 180,814,785 | 19.00 |
| Field crops, miscellaneous..... | 1,115,178 | 17.42 | 265,202,730 | 27.87 |
| Seeds..... | 278,198 | 4.35 | 30,748,600 | 3.23 |
| Vegetables..... | 466,518 | 7.29 | 179,160,636 | 18.83 |
| Fruits and nuts, and miscellaneous..... | 295,819 | 4.62 | 165,831,115 | 17.42 |
| Other ¹ | | | 26,125,465 | 2.75 |
| Total reported..... | 6,717,630 | 104.96 | 951,623,656 | 100.00 |
| Less: Multiple cropped..... | 453,778 | 7.09 | | |
| Plus: Soil building crops..... | 14,623 | .23 | | |
| Cropland not harvested..... | 121,668 | 1.90 | | |
| | 6,400,143 | 100.00 | 951,623,656 | 100.00 |

¹ Additional revenues from Federal and commercial agencies.

The volume of agricultural production totaled nearly 28.4 million tons in 1956, an increase of 1.4 million tons over 1955. Increases were noted for all crop groups except fruits, which decreased about 61,000 tons. The production of cotton was up 99,000 bales, sugar beets increased 544,000 tons, and dry beans fell off about 23,000 tons. Average per acre crop yields were slightly higher than in 1955 for the principal crops produced on most Federal irrigation projects. In all, 1956 was a good crop year.

Average unit prices received by irrigation farmers for their products were generally somewhat higher than in 1955. This was true for all the principal crops except alfalfa hay and canning tomatoes, which decreased 5 and 6 percent, respectively, in 1956.

The most significant crops produced on irrigated project lands in terms of value were cotton, alfalfa, potatoes, sugar beets, grapes,

FIGURE 3.—Irrigated crops like these Columbia Basin project potatoes in Washington State are included in annual Reclamation harvests which in 1956 were valued at more than \$951 million. Federal Reclamation facilities are capable of delivering irrigation water to more than 7½ million acres of land in the 17 Western States. Bureau of Reclamation photo.



wheat, lettuce, apples, pasture, barley, beans, oranges, corn, tomatoes, silage, cantaloupes, pears, peaches, and hops. Together, these crops account for 84 percent of the total crop value on Reclamation projects.

| Crop | Gross crop value | Crop | Gross crop value |
|----------------------------|---------------------------|-----------------------|------------------|
| Cotton and cottonseed..... | \$159, 044, 170 | Dry edible beans..... | \$27, 735, 480 |
| Alfalfa hay..... | 121, 820, 769 | Oranges..... | 20, 993, 213 |
| Sugar beets..... | ¹ 88, 218, 287 | Corn..... | 20, 428, 856 |
| Potatoes..... | 69, 387, 647 | Tomatoes..... | 20, 258, 242 |
| Grapes..... | 40, 682, 339 | Silage..... | 14, 323, 757 |
| Wheat..... | 34, 618, 601 | Cantaloupes..... | 13, 311, 360 |
| Lettuce..... | 32, 555, 177 | Pears..... | 12, 605, 033 |
| Apples..... | 30, 536, 925 | Peaches..... | 11, 736, 398 |
| Pasture..... | 30, 122, 072 | Alfalfa seed..... | 11, 820, 792 |
| Barley..... | 29, 985, 079 | Hops..... | 10, 062, 880 |

¹ Includes value of tops and sugar program payments.

Region 1, with 2,265,209 acres of irrigated lands, the largest in irrigated area of the seven Bureau Regions, produced crops valued at \$269 million. This Region contains 35 percent of the irrigated lands and accounted for 28 percent of the total value of crops produced on all Reclamation projects in 1956. Region 3, with less than half as much irrigated land as Region 1, produced crops valued at \$233 million, or 24 percent of the total production from all Federal projects during the same year. Comparative data for Regions follow :

| Region | Irrigated acres | | Gross crop value | |
|------------|-----------------|---------|------------------|---------|
| | Acres | Percent | Dollars | Percent |
| 1..... | 2, 265, 209 | 35. 4 | 268, 975, 631 | 28. 2 |
| 2..... | 905, 322 | 14. 1 | 226, 182, 968 | 23. 8 |
| 3..... | 907, 245 | 14. 2 | 233, 139, 732 | 24. 5 |
| 4..... | 566, 670 | 8. 9 | 42, 529, 597 | 4. 5 |
| 5..... | 301, 050 | 4. 7 | 56, 801, 792 | 6. 0 |
| 6..... | 462, 004 | 7. 2 | 23, 382, 817 | 2. 5 |
| 7..... | 992, 643 | 15. 5 | 100, 611, 119 | 10. 5 |
| Total..... | 6, 400, 143 | 100. 0 | 951, 623, 656 | 100. 0 |

TABLE 1.—Irrigation and gross crop value data by States

| Region, project, division or reporting entity | State | Full irrigation service lands | | | | Supplemental irrigation service lands |
|---|------------|-------------------------------|----------------|------------------|--------------------|---------------------------------------|
| | | Irrigable area for service | Irrigated area | Gross crop value |  |  | Irrigable area for service |
| | | | | Total | Per irrigated acre | |
| Region 1 | | Acres | Acres | Dollars | Dollars | Acres |
| Arnold | Oregon | 4,292 | 2,891 | 119,639 | 41.38 | |
| Avondale | Idaho | 927 | 383 | 20,667 | 53.96 | |
| Baker | Oregon | | | | | 7,312 |
| Bitter Root | Montana | 16,665 | 16,340 | 588,779 | 36.03 | |
| Boise (Idaho-Oregon): | | | | | | |
| Arrowrock Division: | | | | | | |
| Big Bend Irrigation District | Oregon | 1,724 | 1,450 | 84,771 | 58.46 | |
| Boise-Kuna Irrigation District | Idaho | 48,660 | 45,110 | 3,821,942 | 84.72 | |
| Nampa and Meridian Irrigation District | do | 40,265 | 35,341 | 3,001,401 | 84.93 | |
| New York Irrigation District | do | 17,826 | 14,170 | 708,934 | 50.03 | |
| Settlers Irrigation District | do | 518 | 500 | 47,472 | 94.94 | |
| Wilder Irrigation District | do | 56,563 | 50,085 | 7,087,384 | 141.51 | |
| Totals, Arrowrock Division | | 165,556 | 146,656 | 14,751,904 | 100.59 | |
| Payette Division: | | | | | | |
| Black Canyon Irrigation District, Unit 1. | Idaho | 6,894 | 6,173 | 1,187,870 | 192.43 | |
| Black Canyon Irrigation District, Unit 2. | do | 51,764 | 48,848 | 3,346,237 | 68.50 | |
| Totals, Payette Division | | 58,658 | 55,021 | 4,534,107 | 82.41 | |
| Special and Warren Act Contractors: | | | | | | |
| Ballantyne Ditch Co. | Idaho | | | | | 780 |
| Boise Valley Irrigation Ditch Co. | do | | | | | 2,729 |
| Capitol View Irrigation District | do | | | | | 515 |
| Emmett Irrigation District | do | | | | | 22,269 |
| Farmers Cooperative Irrigation District | do | | | | | 15,500 |
| Farmers Union Ditch Co. | do | | | | | 8,200 |
| Nampa and Meridian Irrigation District | do | | | | | 26,188 |
| New Dry Creek Ditch Co. | do | | | | | 2,720 |
| Pioneer Irrigation District | do | | | | | 34,050 |
| Riverside Irrigation District | do | | | | | 9,573 |
| Settlers Irrigation District | do | | | | | 10,115 |
| South Boise Mutual Irrigation District | do | | | | | 745 |
| Totals, Special and Warren Act Contractors. | | | | | | 133,384 |
| Totals, Boise project. | | 224,214 | 201,677 | 19,286,011 | 95.63 | 133,384 |
| Burnt River | Oregon | | | | | 15,230 |
| Columbia Basin: | | | | | | |
| East Columbia Basin Irrigation District | Washington | 111,726 | 70,653 | 10,314,053 | 145.98 | |
| Quincy-Columbia Basin Irrigation District | do | 121,933 | 73,286 | 9,165,440 | 125.06 | |
| South Columbia Basin Irrigation District | do | 72,028 | 30,849 | 2,933,588 | 95.10 | |
| Totals, Columbia Basin project | | 305,687 | 174,788 | 22,413,081 | 128.23 | |
| Crescent Lake Dam | Oregon | 6,831 | 6,178 | 297,595 | 48.17 | |
| Dalton Gardens | Idaho | 944 | 396 | 31,922 | 80.61 | |
| Deschutes: | | | | | | |
| Central Oregon Irrigation District | Oregon | | | | | 46,620 |
| Crook County Improvement District No. 1. | do | | | | | 2,520 |
| North Unit Irrigation District | do | 50,000 | 46,951 | 6,014,045 | 128.09 | |
| Totals, Deschutes project. | | 50,000 | 46,951 | 6,014,045 | 128.09 | 49,140 |
| Frenchtown | Montana | 4,810 | 3,802 | 217,039 | 57.09 | |
| Grants Pass | Oregon | 10,309 | 7,378 | 910,119 | 123.36 | |
| Lewiston Orchards | Idaho | 3,589 | 2,085 | 447,624 | 214.69 | |

TABLE 1.—Irrigation and gross crop value data by States

| Region, project, division or reporting entity | State | Full irrigation service lands | | | | Supplemental irrigation service lands |
|---|---------------|-------------------------------|----------------|------------------|--------------------|---------------------------------------|
| | | Irrigable area for service | Irrigated area | Gross crop value | | Irrigable area for service |
| | | | | Total | Per irrigated acre | |
| Region 1—Continued | | | | | | |
| Minidoka: | | Acres | Acres | Dollars | Dollars | Acres |
| American Falls Reservoir District No. 2. | Idaho-Wyoming | 98,462 | 82,346 | 5,847,019 | 71.01 | |
| Burley Irrigation District | do. | 47,911 | 44,209 | 3,968,702 | 89.77 | |
| Minidoka Irrigation District | do. | 71,925 | 63,381 | 5,784,079 | 91.26 | |
| North Side Pumping Division | do. | 26,677 | 23,511 | 2,806,788 | 119.38 | |
| Fremont-Madison Irrigation District. | do. | | | | | 112,000 |
| Special and Warren Act Contractors: | | | | | | |
| Aberdeen-Springfield Canal Co. | do. | | | | | 63,000 |
| Blackfoot Irrigation Co. | do. | | | | | 18,000 |
| Burgess Canal and Irrigating Co. | do. | | | | | 23,000 |
| Butte and Market Lake Canal Co. | do. | | | | | 20,000 |
| Corbett Slough Ditch Co. | do. | | | | | 6,200 |
| Dilts Irrigation Co. | do. | | | | | 800 |
| Enterprise Canal Co., Ltd. | do. | | | | | 5,500 |
| Enterprise Irrigation District | do. | | | | | 6,000 |
| Farmers Friend Irrigation Co. | do. | | | | | 11,000 |
| Harrison Canal and Irrigation Co. | do. | | | | | 14,000 |
| Hillsdale Irrigation District | do. | | | | | 21,000 |
| Idaho Irrigation District | do. | | | | | 37,500 |
| Individual Contractors (2) | do. | | | | | 290 |
| Lenroot Canal Co. | do. | | | | | 4,450 |
| Lowder Slough Canal Co., Ltd. | do. | | | | | 1,100 |
| Martin Canal Co. | do. | | | | | 1,400 |
| Milner Low Lift Irrigation District. | do. | | | | | 12,444 |
| New Sweden Irrigation District | do. | | | | | 26,500 |
| North Side Canal Co., Ltd. | do. | | | | | 165,000 |
| Osgood Canal Co. | do. | | | | | 7,000 |
| Owners Mutual Irrigation Co. | do. | | | | | 980 |
| People's Canal and Irrigation Co. | do. | | | | | 20,500 |
| Poplar Irrigation District | do. | | | | | 900 |
| Progressive Irrigation District | do. | | | | | 33,000 |
| Reid Canal Co. | do. | | | | | 5,400 |
| Rudy Irrigation Canal Co. | do. | | | | | 5,800 |
| Snake River Valley Irrigation District. | do. | | | | | 23,000 |
| Sunnydell Irrigation District | do. | | | | | 4,000 |
| Trego Ditch Co. | do. | | | | | 1,900 |
| Twin Falls Canal Co. | do. | | | | | 205,000 |
| Woodville Canal Co. | do. | | | | | 3,500 |
| Totals, Special and Warren Act Contractors. | | | | | | 748,164 |
| Leased Lands | | | | | | |
| Totals, Minidoka project | | 244,975 | 213,447 | 18,406,588 | 86.23 | 860,164 |
| Missoula Valley | Montana | 977 | 768 | 29,093 | 37.88 | |
| Ochoco | Oregon | 8,500 | 8,333 | 651,145 | 78.14 | |
| Okanogan | Washington | 5,307 | 3,972 | 650,545 | 163.78 | |
| Owyhee Idaho-Oregon: | | | | | | |
| North Division: | | | | | | |
| Advancement Irrigation District. | Oregon | 700 | 543 | 107,416 | 197.82 | |
| Bench Irrigation District | do. | 2,319 | 2,249 | 646,812 | 287.60 | |
| Crystal Irrigation District | do. | 1,280 | 1,206 | 330,242 | 273.83 | |
| Ontario-Nyssa Irrigation District. | do. | 5,831 | 5,602 | 1,363,364 | 243.37 | |
| Owyhee Irrigation District | do. | 49,583 | 46,640 | 5,397,703 | 115.73 | |
| Payette-Oregon Slope Irrigation District. | do. | 4,699 | 4,402 | 1,203,760 | 273.46 | |
| Slide Irrigation District | do. | 1,144 | 1,079 | 201,656 | 186.89 | |
| Totals, North Division | | 65,556 | 61,721 | 9,250,953 | 149.88 | |

for each project and reporting organization, 1956—Continued

| Supplemental irrigation service lands—Continued | | | Temporary irrigation service lands | | | | Total | | | |
|---|------------------|--------------------|------------------------------------|----------------|------------------|--------------------|----------------------------|----------------|------------------|--------------------|
| Irrigated area | Gross crop value | | Irrigable area for service | Irrigated area | Gross crop value | | Irrigable area for service | Irrigated area | Gross crop value | |
| | Total | Per irrigated acre | | | Total | Per irrigated acre | | | Total | Per irrigated acre |
| Acres | Dollars | Dollars | Acres | Acres | Dollars | Dollars | Acres | Acres | Dollars | Dollars |
| | | | | | | | 98,462 | 82,346 | 5,847,019 | 71.01 |
| | | | | | | | 47,911 | 44,209 | 3,968,702 | 89.77 |
| | | | | | | | 71,925 | 63,381 | 5,784,079 | 91.26 |
| | | | | | | | 26,677 | 23,511 | 2,806,788 | 119.38 |
| 104,164 | 10,170,867 | 97.64 | | | | | 112,000 | 104,164 | 10,170,867 | 97.64 |
| | | | | | | | | | | |
| 49,806 | 3,957,463 | 79.46 | | | | | 63,000 | 49,806 | 3,957,463 | 79.46 |
| 15,000 | 1,125,158 | 75.01 | | | | | 18,000 | 15,000 | 1,125,158 | 75.01 |
| 22,690 | 2,264,997 | 99.82 | | | | | 23,000 | 22,690 | 2,264,997 | 99.82 |
| 18,500 | 1,404,605 | 75.92 | | | | | 20,000 | 18,500 | 1,404,605 | 75.92 |
| 6,000 | 461,034 | 76.84 | | | | | 6,200 | 6,000 | 461,034 | 76.84 |
| 800 | 49,394 | 61.74 | | | | | 800 | 800 | 49,394 | 61.74 |
| 5,000 | 383,266 | 76.65 | | | | | 5,500 | 5,000 | 383,266 | 76.65 |
| 5,885 | 642,613 | 109.20 | | | | | 6,000 | 5,885 | 642,613 | 109.20 |
| 10,750 | 993,607 | 92.43 | | | | | 11,000 | 10,750 | 993,607 | 92.43 |
| 13,000 | 950,622 | 73.12 | | | | | 14,000 | 13,000 | 950,622 | 73.12 |
| 20,500 | 1,657,059 | 80.83 | | | | | 21,000 | 20,500 | 1,657,059 | 80.83 |
| 35,940 | 2,691,294 | 74.88 | | | | | 37,500 | 35,940 | 2,691,294 | 74.88 |
| 283 | 26,102 | 92.23 | | | | | 290 | 283 | 26,102 | 92.23 |
| 4,200 | 265,341 | 63.18 | | | | | 4,450 | 4,200 | 265,341 | 63.18 |
| 1,100 | 70,016 | 63.65 | | | | | 1,100 | 1,100 | 70,016 | 63.65 |
| 1,320 | 98,179 | 74.38 | | | | | 1,400 | 1,320 | 98,179 | 74.38 |
| 11,560 | 1,106,526 | 95.72 | | | | | 12,444 | 11,560 | 1,106,526 | 95.72 |
| | | | | | | | | | | |
| 26,000 | 2,286,850 | 87.96 | | | | | 26,500 | 26,000 | 2,286,850 | 87.96 |
| 161,480 | 11,947,880 | 73.99 | | | | | 165,000 | 161,480 | 11,947,880 | 73.99 |
| 6,550 | 715,569 | 109.25 | | | | | 7,000 | 6,550 | 715,569 | 109.25 |
| 880 | 79,944 | 90.85 | | | | | 980 | 880 | 79,944 | 90.85 |
| 20,000 | 1,477,288 | 73.86 | | | | | 20,500 | 20,000 | 1,477,288 | 73.86 |
| 870 | 66,078 | 75.95 | | | | | 900 | 870 | 66,078 | 75.95 |
| 31,655 | 2,420,779 | 76.47 | | | | | 33,000 | 31,655 | 2,420,779 | 76.47 |
| 5,300 | 490,406 | 92.53 | | | | | 5,400 | 5,300 | 490,406 | 92.53 |
| 5,500 | 426,034 | 77.46 | | | | | 5,800 | 5,500 | 426,034 | 77.46 |
| 21,280 | 1,559,184 | 73.27 | | | | | 23,000 | 21,280 | 1,559,184 | 73.27 |
| | | | | | | | | | | |
| 3,800 | 235,171 | 61.89 | | | | | 4,000 | 3,800 | 235,171 | 61.89 |
| 1,895 | 147,632 | 77.91 | | | | | 1,900 | 1,895 | 147,632 | 77.91 |
| 193,400 | 16,469,434 | 85.16 | | | | | 205,000 | 193,400 | 16,469,434 | 85.16 |
| 3,025 | 308,765 | 102.07 | | | | | 3,500 | 3,025 | 308,765 | 102.07 |
| 703,969 | 56,778,290 | 80.65 | | | | | 748,164 | 703,969 | 56,778,290 | 80.65 |
| | | | 509 | 509 | 50,824 | 99.85 | 509 | 509 | 50,824 | 99.85 |
| 808,133 | 66,949,157 | 82.84 | 509 | 509 | 50,824 | 99.85 | 1,105,648 | 1,022,089 | 85,406,569 | 83.56 |
| | | | | | | | | | | |
| | | | | | | | 977 | 768 | 29,093 | 37.88 |
| | | | | | | | 8,500 | 8,333 | 651,145 | 78.14 |
| | | | | | | | 5,307 | 3,972 | 650,545 | 163.78 |
| | | | | | | | | | | |
| | | | | | | | 700 | 543 | 107,416 | 197.82 |
| | | | | | | | 2,319 | 2,249 | 646,812 | 287.60 |
| | | | | | | | 1,280 | 1,206 | 330,242 | 273.83 |
| | | | | | | | 5,831 | 5,602 | 1,363,364 | 243.37 |
| | | | | | | | 49,583 | 46,640 | 5,397,703 | 115.73 |
| | | | | | | | 4,699 | 4,402 | 1,203,760 | 273.46 |
| | | | | | | | 1,144 | 1,079 | 201,656 | 186.89 |
| | | | | | | | 65,556 | 61,721 | 9,250,953 | 149.88 |

TABLE 1.—Irrigation and gross crop value data by States

| Region, project, division or reporting entity | State | Full irrigation service lands | | | | Supplemental irrigation service lands |
|---|------------|-------------------------------|----------------|------------------|--------------------|---------------------------------------|
| | | Irrigable area for service | Irrigated area | Gross crop value |  |  | Irrigable area for service |
| | | | | Total | Per irrigated acre | |
| Region 1—Continued | | | | | | |
| Owyhee Idaho-Oregon—Continued | | | | | | |
| South Division: | | Acres | Acres | Dollars | Dollars | Acres |
| Gem Irrigation District | Idaho | 33,454 | 31,286 | 3,480,616 | 111.25 | |
| Ridgeview Irrigation District | Oregon | 6,159 | 5,973 | 704,124 | 117.88 | |
| Totals, South Division | | 39,613 | 37,259 | 4,184,740 | 112.31 | |
| Owyhee Ditch Company | Oregon | | | | | 13,800 |
| Totals, Owyhee project | | 105,169 | 98,980 | 13,435,693 | 135.74 | 13,800 |
| Rathdrum Prairie: | | | | | | |
| Hayden Lake Unit | Idaho | 1,097 | 546 | 51,592 | 94.49 | |
| Post Falls Unit | do | 3,195 | 2,942 | 272,066 | 92.48 | |
| Totals, Rathdrum Prairie project. | | 4,292 | 3,488 | 323,658 | 92.79 | |
| Rogue River Basin: | | | | | | |
| Medford Irrigation District | Oregon | | | | | 9,220 |
| Rogue River Valley Irrigation District. | do | | | | | 4,900 |
| Totals, Rogue River Basin project. | | | | | | 14,120 |
| Umatilla: | | | | | | |
| East Division: | | | | | | |
| Hermiston Irrigation District | Oregon | 11,000 | 6,529 | 338,706 | 51.88 | |
| South Division: | | | | | | |
| Stanfield Irrigation District | do | | | | | 6,000 |
| Westland Irrigation District | do | | | | | 8,229 |
| West Division: | | | | | | |
| West Extension Irrigation District. | do | 7,033 | 5,594 | 289,891 | 51.82 | |
| Totals, Umatilla project | | 18,033 | 12,123 | 628,597 | 51.85 | 14,229 |
| Vale | Oregon | 32,000 | 31,594 | 2,192,167 | 69.39 | |
| Yakima: | | | | | | |
| Kennewick Division | Washington | 4,637 | 2,237 | 323,160 | 144.46 | |
| Kittitas Division | do | 57,400 | 54,334 | 2,719,945 | 50.06 | |
| Roza Division | do | 72,730 | 66,508 | 14,677,778 | 220.69 | |
| Sunnyside Division: | | | | | | |
| Grandview Irrigation District | do | 3,941 | 2,986 | 811,941 | 271.92 | |
| Granger Irrigation District | do | 1,600 | 1,366 | 196,609 | 143.93 | |
| Outlook Irrigation District | do | 4,741 | 4,376 | 819,228 | 187.21 | |
| Prosser Irrigation District | do | 2,155 | 1,661 | 253,523 | 152.63 | |
| Snipes Mountain Irrigation District. | do | 1,915 | 1,485 | 229,375 | 154.46 | |
| Sunnyside Irrigation District | do | 4,630 | 3,166 | 343,311 | 108.44 | |
| Sunnyside Valley Irrigation District. | do | 84,312 | 64,927 | 13,332,908 | 205.35 | |
| Totals, Sunnyside Division | | 103,294 | 79,967 | 15,986,895 | 199.92 | |
| Tieton Division | Washington | 27,271 | 24,084 | 17,618,273 | 731.53 | |
| Special and Warren Act Contractors: | | | | | | |
| Broadway Irrigation Co | do | | | | | 350 |
| Cascade Irrigation District | do | | | | | 12,710 |
| City of Yakima (Urban lots) | do | | | | | 2,380 |
| Moxee Sub "A" | do | | | | | 345 |
| Naches-Selah Irrigation District | do | | | | | 10,000 |
| Selah-Moxee Irrigation District. | do | | | | | 4,600 |
| Small Warren Act Contractors | do | | | | | 104 |
| Terrace Heights Irrigation District. | do | | | | | 565 |
| Union Gap Irrigation District | do | | | | | 3,407 |
| Wapato Irrigation District | do | | | | | 136,000 |
| West Side Irrigating Co | do | | | | | 7,000 |
| Yakima Valley Canal Co | do | | | | | 4,300 |
| Totals, Special and Warren Act Contractors. | | | | | | 181,761 |
| Totals, Yakima project. | | 265,332 | 227,130 | 51,326,051 | 225.98 | 181,761 |
| Totals, Region 1 | | 1,312,853 | 1,062,704 | 137,990,058 | 129.85 | 1,289,140 |

for each project and reporting organization, 1956—Continued

| Supplemental irrigation service lands—Continued | | | Temporary irrigation service lands | | | | Total | | | |
|--|---|---|---------------------------------------|------------------------|------------------|----------------------------|---|---|---|--|
| Irrigated area | Gross crop value | | Irrig- able area for service | Irrig- ated area | Gross crop value | | Irrigable area for service | Irrigated area | Gross crop value | |
| | Total | Per ir- rigated acre | | | Total | Per ir- rigated acre | | | Total | Per ir- rigated acre |
| Acres | Dollars | Dollars | Acres | Acres | Dollars | Dollars | Acres | Acres | Dollars | Dollars |
| | | | | | | | 33,454 6,159 | 31,286 5,973 | 3,480,616 704,124 | 111.25 117.88 |
| | | | | | | | 39,613 13,800 | 37,259 12,860 | 4,184,740 3,436,099 | 112.31 267.19 |
| 12,860 | 3,436,099 | 267.19 | | | | | 118,969 | 111,840 | 16,871,792 | 150.86 |
| 12,860 | 3,436,099 | 267.19 | | | | | | | | |
| | | | | | | | 1,097 3,196 | 546 2,942 | 51,592 272,066 | 94.49 92.48 |
| | | | | | | | 4,292 | 3,488 | 323,658 | 92.79 |
| | | | | | | | | | | |
| 8,139 4,670 | 2,975,772 1,434,360 | 365.62 307.14 | | | | | 9,220 4,900 | 8,139 4,670 | 2,975,772 1,434,360 | 365.62 307.14 |
| 12,809 | 4,410,132 | 344.30 | | | | | 14,120 | 12,809 | 4,410,132 | 344.30 |
| | | | | | | | | | | |
| | | | | | | | 11,000 | 6,529 | 338,706 | 51.88 |
| 5,207 5,715 | 678,766 612,879 | 130.36 107.24 | | | | | 6,000 8,229 | 5,207 5,715 | 678,766 612,879 | 130.36 107.24 |
| | | | 536 | 503 | 78,273 | 155.61 | 7,569 | 6,097 | 368,164 | 60.38 |
| 10,922 | 1,291,645 | 118.26 | 536 | 503 | 78,273 | 155.61 | 32,798 32,000 | 23,548 31,594 | 1,998,515 2,192,167 | 84.87 69.39 |
| | | | | | | | 4,637 57,400 72,730 | 2,237 54,334 66,508 | 323,160 2,719,945 14,677,778 | 144.46 50.06 220.69 |
| | | | | | | | 3,941 1,600 4,741 2,155 1,915 | 2,986 1,366 4,376 1,661 1,485 | 811,941 196,609 819,228 253,523 229,375 | 271.92 143.93 187.21 152.63 154.46 |
| | | | | | | | 4,630 84,552 | 3,166 65,121 | 343,311 13,360,628 | 108.44 205.17 |
| | | | 240 | 194 | 27,720 | 142.89 | | | | |
| | | | 240 | 194 | 27,720 | 142.89 | 103,534 27,271 | 80,161 24,084 | 16,014,615 17,618,273 | 199.78 731.53 |
| | | | | | | | | | | |
| 235 12,480 | 24,559 851,450 | 104.51 68.23 | | | | | 350 12,710 2,380 | 235 12,480 | 24,559 851,450 | 104.51 68.23 |
| 345 9,760 4,470 94 465 | 157,040 7,364,909 1,599,915 5,908 186,008 | 455.19 754.60 357.92 62.85 400.02 | | | | | 345 10,000 4,600 104 565 | 345 9,760 4,470 94 465 | 157,040 7,364,909 1,599,915 5,908 186,008 | 455.19 754.60 357.92 62.85 400.02 |
| 2,950 123,421 5,510 5,800 | 1,718,430 21,155,118 344,745 2,006,236 | 582.52 171.41 62.57 527.96 | | | | | 3,407 136,000 7,000 4,300 | 2,950 123,421 5,510 3,800 | 1,718,430 21,155,118 344,745 2,006,236 | 582.52 171.41 62.57 527.96 |
| 163,530 | 35,414,318 | 216.56 | | | | | 181,761 | 163,530 | 35,414,318 | 216.56 |
| | | | | | | | | | | |
| 163,530 | 35,414,318 | 216.56 | 240 | 194 | 27,720 | 142.89 | 447,333 | 390,854 | 86,768,089 | 222.00 |
| 1,200,480 | 130,769,997 | 108.93 | 2,104 | 2,025 | 215,576 | 106.46 | 2,604,097 | 2,265,209 | 268,975,631 | 118.74 |

TABLE 1.—Irrigation and gross crop value data by States

| Region, project, division or reporting entity | State | Full irrigation service lands | | | | Supplemental irrigation service lands |
|--|------------|-------------------------------|----------------|------------------|--------------------|---------------------------------------|
| | | Irrigable area for service | Irrigated area | Gross crop value | | |
| | | | | Total | Per irrigated acre | Irrigable area for service |
| <i>Region 2</i> | | <i>Acres</i> | <i>Acres</i> | <i>Dollars</i> | <i>Dollars</i> | <i>Acres</i> |
| Cachuma: | California | | | | | 26,450 |
| Goleta, Carpinteria, and Montecito County Water Districts. | do. | 500 | 61 | | | |
| Summerland County Water District. | do. | | | | | |
| Totals, Cachuma project | | 500 | 61 | | | 26,450 |
| Central Valley: | | | | | | |
| Contra Costa Canal: | | | | | | |
| Contra Costa County Water District. | California | | | | | 7,297 |
| Delta-Mendota Canal and San Joaquin River: | | | | | | |
| Borland Water District ² | do. | | | | | 5,785 |
| Broadview Water District | do. | | | | | 9,300 |
| Columbia Canal Co. ² | do. | | | | | 464 |
| Crows Landing Naval Base ³ | do. | | | | | 748 |
| Davis Water District | do. | 1,990 | 910 | 136,294 | 149.77 | |
| Del Puerto Water District | do. | 3,624 | 3,178 | 1,601,179 | 503.83 | |
| Eagle Field Water Users Association. | do. | | | | | 1,441 |
| Foothill Water District | do. | 1,967 | 1,831 | 315,344 | 172.23 | |
| Fresno Slough Water District | do. | | | | | 1,341 |
| Hospital Water District | do. | 7,621 | 7,238 | 3,159,575 | 436.53 | |
| Melvin D. Hughes | do. | | | | | 50 |
| James Irrigation District | do. | | | | | 24,410 |
| Kern Canon Water District | do. | 2,950 | 2,665 | 865,344 | 324.71 | |
| Laguna Water Association | do. | | | | | |
| Mercy Springs Water District | do. | | | | | |
| Mustang Water District | do. | | | | | 3,712 |
| Orestimba Water District | do. | 4,765 | 4,605 | 1,197,764 | 260.10 | |
| Oro Loma Water District | do. | | | | | 1,128 |
| Panoche Water District | do. | | | | | 38,240 |
| Patterson Water District | do. | | | | | 14,300 |
| Plain View Water District | do. | 5,419 | 4,844 | 1,440,457 | 297.37 | |
| Quinto Water District | do. | | | | | 2,173 |
| Reclamation District No. 1606 | do. | | | | | 115 |
| Romero Water District | do. | | | | | 1,323 |
| Salado Water District | do. | 2,786 | 2,773 | 845,214 | 304.80 | |
| San Luis Water District | do. | | | | | 45,755 |
| Sunflower Water District | do. | 2,671 | 2,579 | 861,886 | 334.19 | |
| Traction Ranch (Frank Arcelus). | do. | | | | | 2,859 |
| Tranquillity Irrigation District | do. | | | | | 9,527 |
| West Stanislaus Irrigation District. | do. | | | | | 21,532 |
| Widren Water Users Association. | do. | | | | | 795 |
| Lands Outside of Districts | do. | | | | | |
| Totals, Delta-Mendota Canal and San Joaquin River. | | 33,793 | 30,623 | 10,423,057 | 340.37 | 184,998 |
| Friant-Kern Canal: | | | | | | |
| Cloer Community Services District. | California | | | | | |
| Cottonwood Ditch Association | do. | | | | | |
| Delano-Earlimart Irrigation District. | do. | | | | | 53,150 |
| Exeter Irrigation District | do. | | | | | 13,595 |
| Homeland Reclamation District. | do. | | | | | |
| International Water District | do. | | | | | |
| Ivanhoe Irrigation District | do. | | | | | 10,358 |
| Kings County Water District | do. | | | | | |
| Lewis Creek Water District | do. | | | | | |
| Lindmore Irrigation District | do. | | | | | 26,627 |
| Lindsay-Strathmore Irrigation District. | do. | | | | | 13,984 |
| Lovell Community Services trict. ² | do. | | | | | 3,898 |

for each project and reporting organization, 1956—Continued

| Supplemental irrigation service lands—Continued | | | Temporary irrigation service lands | | | | Total | | | |
|--|------------------|----------------------------|---------------------------------------|------------------------|--------------------|----------------------------|----------------------------------|----------------------------|-------------------------------------|-------------------------------|
| Irrigated area | Gross crop value | | Irri- gable area for service | Irri- gated area | Gross crop value | | Irrigable area for service | Irrigated area | Gross crop value | |
| | Total | Per ir- rigated acre | | | Total | Per ir- rigated acre | | | Total | Per ir- rigated acre |
| <i>Acres</i> | <i>Dollars</i> | <i>Dollars</i> | <i>Acres</i> | <i>Acres</i> | <i>Dollars</i> | <i>Dollars</i> | <i>Acres</i> | <i>Acres</i> | <i>Dollars</i> | <i>Dollars</i> |
| 12, 246 | 8, 373, 399 | 683. 77 | | | | | 26, 450 | 12, 246 | 8, 373, 399 | 683. 77 |
| | | | | | | | 500 | 61 | | |
| 12, 246 | 8, 373, 399 | 683. 77 | | | | | 26, 950 | 12, 307 | 8, 373, 399 | 680. 38 |
| 6, 302 | 2, 213, 403 | 351. 22 | | | | | 7, 297 | 6, 302 | 2, 213, 403 | 351. 22 |
| 7, 361 | 1, 325, 061 | 180. 01 | | | | | 5, 785 9, 300 464 748 | 7, 361 | 1, 325, 061 | 180. 01 |
| 1, 304 | 292, 464 | 224. 28 | | | | | 1, 990 3, 624 1, 441 | 910 3, 178 1, 304 | 136, 294 1, 601, 179 292, 464 | 149. 77 503. 83 224. 28 |
| 1, 201 | 103, 687 | 86. 33 | | | | | 1, 967 1, 341 7, 621 | 1, 831 1, 201 7, 238 | 315, 344 103, 687 3, 159, 575 | 172. 23 86. 33 436. 53 |
| 50 | 1, 485 | 29. 70 | | | | | 50 | 50 | 1, 485 | 29. 70 |
| 18, 940 | 3, 701, 360 | 195. 43 | | | | | 24, 410 2, 950 131 | 18, 940 2, 665 125 | 3, 701, 360 865, 344 6, 634 | 195. 43 324. 71 53. 07 |
| 2, 297 | 787, 251 | 342. 73 | 131 3, 400 | 125 1, 910 | 6, 634 380, 611 | 53. 07 199. 27 | 3, 400 3, 712 4, 765 | 1, 910 2, 297 4, 605 | 380, 611 787, 251 1, 197, 764 | 199. 27 342. 73 260. 10 |
| 865 | 190, 344 | 220. 05 | | | | | 1, 128 | 865 | 190, 344 | 220. 05 |
| 32, 199 | 7, 365, 292 | 228. 74 | | | | | 38, 240 | 32, 199 | 7, 365, 292 | 228. 74 |
| 13, 800 | 3, 875, 303 | 280. 82 | | | | | 14, 300 | 13, 800 | 3, 875, 303 | 280. 82 |
| 888 | 158, 033 | 177. 97 | | | | | 5, 419 | 4, 844 | 1, 440, 457 | 297. 37 |
| 90 | 13, 817 | 153. 52 | | | | | 2, 173 | 888 | 158, 033 | 177. 97 |
| 895 | 292, 424 | 326. 73 | | | | | 115 | 90 | 13, 817 | 153. 52 |
| 19, 895 | 4, 165, 637 | 209. 38 | | | | | 1, 323 | 895 | 292, 424 | 326. 73 |
| 1, 615 | 130, 428 | 80. 76 | | | | | 2, 786 | 2, 773 | 845, 214 | 304. 80 |
| 8, 756 | 1, 775, 597 | 202. 79 | | | | | 45, 755 | 19, 895 | 4, 165, 637 | 209. 38 |
| 21, 000 | 6, 578, 752 | 313. 27 | | | | | 2, 671 | 2, 579 | 861, 886 | 334. 19 |
| 710 | 178, 399 | 251. 27 | | | | | 2, 859 | 1, 615 | 130, 428 | 80. 76 |
| 131, 866 | 30, 935, 334 | 234. 60 | | | | | 9, 527 | 8, 756 | 1, 775, 597 | 202. 79 |
| | | | | | | | 21, 532 | 21, 000 | 6, 578, 752 | 313. 27 |
| | | | | | | | 795 | 710 | 178, 399 | 251. 27 |
| | | | 711 | 711 | 168, 211 | 236. 58 | 711 | 711 | 168, 211 | 236. 58 |
| | | | | | | | 223, 033 | 165, 235 | 41, 913, 847 | 253. 66 |
| | | | | | | | | | | |
| | | | 165 | 160 | 86, 800 | 542. 50 | 165 | 160 | 86, 800 | 542. 50 |
| 48, 103 | 25, 419, 533 | 528. 44 | 452 | 435 | 111, 474 | 256. 26 | 452 | 435 | 111, 474 | 256. 26 |
| 10, 975 | 5, 273, 425 | 480. 49 | | | | | 53, 150 | 48, 103 | 25, 419, 533 | 528. 44 |
| | | | 7, 576 | 7, 425 | 573, 970 | 77. 30 | 13, 595 | 10, 975 | 5, 273, 425 | 480. 49 |
| | | | | | | | 7, 576 | 7, 425 | 573, 970 | 77. 30 |
| 9, 353 | 4, 679, 695 | 500. 34 | 483 | 470 | 27, 025 | 57. 50 | 483 | 470 | 27, 025 | 57. 50 |
| | | | 2, 060 | 2, 000 | 285, 338 | 142. 67 | 10, 358 | 9, 353 | 4, 679, 695 | 500. 34 |
| 24, 497 | 10, 297, 324 | 420. 35 | 1, 217 | 394 | 151, 941 | 385. 64 | 2, 060 | 2, 000 | 285, 338 | 142. 67 |
| 10, 260 | 6, 610, 160 | 644. 27 | | | | | 1, 217 | 394 | 151, 941 | 385. 64 |
| | | | | | | | 26, 627 | 24, 497 | 10, 297, 324 | 420. 35 |
| | | | | | | | 13, 984 | 10, 260 | 6, 610, 160 | 644. 27 |
| | | | | | | | 3, 898 | | | |

TABLE 1.—Irrigation and gross crop value data by States

| Region, project, division or reporting entity | State | Full irrigation service lands | | | | Supple- mental irrigation service lands |
|--|------------|----------------------------------|-------------------|------------------|----------------------------|---|
| | | Irrigable area for service | Irrigated area | Gross crop value | | Irrigable area for service |
| | | | | Total | Per ir- rigated acre | |
| <i>Region 2—Continued</i> | | | | | | |
| Friant-Kern—Continued | | <i>Acres</i> | <i>Acres</i> | <i>Dollars</i> | <i>Dollars</i> | <i>Acres</i> |
| Lower Tule River Irrigation District. | California | | | | | 93,688 |
| Nunes Water District | do. | | | | | |
| Orange Cove Irrigation District. | do. | | | | | 26,068 |
| Porterville Irrigation District. | do. | | | | | 15,614 |
| Rag Gulch Water District | do. | | | | | |
| Saucelito Irrigation District. | do. | | | | | 18,661 |
| South Lake Farms, Inc. | do. | | | | | |
| Southern San Joaquin Municipal Utility District. | do. | | | | | 59,053 |
| Stone Corral Irrigation District. | do. | | | | | 5,493 |
| Terra Bella Irrigation District. | do. | | | | | 12,064 |
| Tulare Irrigation District. | do. | | | | | 69,674 |
| Tulare Lake Basin Water Storage District. | do. | | | | | |
| Yetttem-Seville Community Services District. | do. | | | | | |
| Totals, Friant-Kern Canal | | | | | | 421,927 |
| Madera Canal: | | | | | | |
| Chowchilla Water District. | do. | | | | | 58,615 |
| Madera Irrigation District. | do. | | | | | 106,611 |
| Totals, Madera Canal | | | | | | 165,226 |
| Sly Park Unit: | | | | | | |
| El Dorado Irrigation District. | do. | | | | | 10,700 |
| Totals, Central Valley Project. | | 33,793 | 30,623 | 10,423,057 | 340.37 | 790,148 |
| Klamath, California-Oregon: | | | | | | |
| Main Division | Oregon | 39,344 | 33,505 | 3,448,629 | 102.93 | |
| Tule Lake Division. | do. | 2,088 | 2,030 | 290,007 | 142.86 | |
| Special and Warren Act Contractors. | do. | 81,775 | 71,955 | 6,830,093 | 94.92 | |
| Miscellaneous Rentals | do. | 4,800 | 4,000 | 463,836 | 115.96 | |
| Lease Lands. | do. | 12,256 | 5,242 | 250,444 | 47.78 | |
| Totals, Oregon | | 140,263 | 116,732 | 11,283,009 | 96.66 | |
| Tule Lake Division. | California | 41,686 | 40,878 | 5,273,470 | 129.01 | |
| Tule Lake Sump | do. | 1,190 | 1,190 | 109,071 | 91.66 | |
| Lower Klamath Lake Rentals. | do. | 5,722 | 5,019 | 264,926 | 52.78 | |
| Miscellaneous Rentals | do. | 244 | 244 | 17,304 | 70.92 | |
| Lease Lands. | do. | 29,707 | 25,414 | 1,719,465 | 67.66 | |
| Totals, California | | 78,549 | 72,745 | 7,384,236 | 101.51 | |
| Totals, Klamath project | | 218,812 | 189,477 | 18,667,245 | 98.52 | |
| Orland. | California | 19,444 | 17,260 | 1,719,384 | 99.62 | |
| Totals, Region 2 | | 272,549 | 237,421 | 30,809,686 | 129.77 | 816,598 |
| <i>Region 3</i> | | | | | | |
| Boulder Canyon, Arizona-California-Nevada: | | | | | | |
| All-American Canal System: | | | | | | |
| Coachella Division | California | 77,287 | 53,777 | 29,859,636 | 555.25 | |
| Imperial Division | do. | 530,000 | 482,374 | 93,203,180 | 193.22 | |
| Totals, Boulder Canyon project. | | 607,287 | 536,151 | 123,062,816 | 229.53 | |

TABLE 1.—Irrigation and gross crop value data by States

| Region, project, division or reporting entity | State | Full irrigation service lands | | | | Supple- mental irrigation service lands |
|--|-----------------|----------------------------------|------------------------|-----------------------------|----------------------------|---|
| | | Irrigable area for service | Irrigated area | Gross crop value | | Irrigable area for service |
| | | | | Total | Per ir- rigated acre | |
| <i>Region 3—Continued</i> | | | | | | |
| Gila: Wellton-Mohawk Division..... | Arizona..... | <i>Acres</i> 69,300 | <i>Acres</i> 34,939 | <i>Dollars</i> 5,197,880 | <i>Dollars</i> 148.77 | |
| Yuma Mesa Division: | | | | | | |
| North Gila unit..... | do..... | 6,715 | 6,581 | 1,947,239 | 295.89 | |
| South Gila unit..... | do..... | 1,985 | 1,985 | 207,508 | 104.54 | |
| Yuma Mesa unit..... | do..... | 19,970 | 13,473 | 1,442,701 | 107.08 | |
| Totals, Yuma Mesa Divi- sion..... | | 28,670 | 22,039 | 3,597,448 | 163.23 | |
| Totals, Gila project..... | | 97,970 | 56,978 | 8,795,328 | 154.36 | |
| Salt River: | | | | | | |
| Salt River Valley Water Users' Association..... | Arizona..... | 239,581 | 177,988 | 59,203,483 | 332.63 | |
| Special contractors: | | | | | | |
| Fort McDowell Indian Reser- vation..... | do..... | | | | | 600 |
| Peninsula-Horowitz Irrigation District..... | do..... | | | | | 2,262 |
| Pima Area Indians-Gila Cross- ing District..... | do..... | | | | | 2,992 |
| Pima Area Indians-Maricopa Colony District..... | do..... | | | | | 1,080 |
| Roosevelt Irrigation District..... | do..... | | | | | 38,014 |
| Roosevelt Water Conservation District..... | do..... | | | | | 39,425 |
| Salt River Indian Reservation..... | do..... | | | | | 9,304 |
| St. Johns Irrigation District..... | do..... | | | | | 2,031 |
| Totals, special contractors..... | | | | | | 95,708 |
| Totals, Salt River project..... | | 239,581 | 177,988 | 59,203,483 | 332.63 | 95,708 |
| Yuma, Arizona-California: | | | | | | |
| Reservation Division: | | | | | | |
| Bard unit..... | California..... | 6,867 | 5,615 | 1,170,407 | 208.44 | |
| Indian unit..... | do..... | 7,743 | 3,845 | 939,360 | 244.31 | |
| Valley Division..... | Arizona..... | 51,936 | 46,430 | 18,886,884 | 406.78 | |
| Totals, Yuma project..... | | 66,546 | 55,890 | 20,996,651 | 375.68 | |
| Yuma Auxiliary: | | | | | | |
| Unit B Irrigation and Drainage District..... | Arizona..... | 3,305 | 2,489 | 677,096 | 272.04 | |
| Warren Act Lands..... | do..... | 118 | 108 | 44,899 | 415.73 | |
| Totals, Yuma Auxiliary proj- ect..... | | 3,423 | 2,597 | 721,995 | 278.01 | |
| Totals, Region 3..... | | 1,014,807 | 829,604 | 212,780,273 | 256.48 | 95,708 |
| <i>Region 4</i> | | | | | | |
| Eden..... | Wyoming..... | 10,070 | 8,571 | 300,659 | 35.08 | |
| Fruitgrowers Dam..... | Colorado..... | | | | | 2,662 |
| Grand Valley: | | | | | | |
| Garfield Gravity Division..... | do..... | 23,317 | 21,508 | 1,952,695 | 90.79 | |
| Orchard Mesa Division..... | do..... | 10,027 | 7,246 | 2,073,661 | 286.18 | |
| Mesa County Irrigation District and Pal'sade Irrigation District..... | do..... | | | | | 7,730 |
| Garfield Gravity Division—Leased Lands..... | do..... | 1,421 | 77 | 6,518 | 84.65 | |
| Totals, Grand Valley project..... | | 34,765 | 28,831 | 4,032,874 | 139.88 | 7,730 |
| Humboldt..... | Nevada..... | | | | | 40,500 |
| Hyrum..... | Utah..... | | | | | 6,800 |
| Mancos..... | Colorado..... | | | | | 8,761 |
| Moon Lake..... | Utah..... | | | | | 75,256 |

for each project and reporting organization, 1956—Continued

| Supplemental irrigation service lands—Continued | | | Temporary irrigation service lands | | | | Total | | | |
|--|------------------|----------------------------|---------------------------------------|------------------------|------------------|----------------------------|----------------------------------|-------------------|------------------|----------------------------|
| Irrigated area | Gross crop value | | Irri- gable area for service | Irri- gated area | Gross crop value | | Irrigable area for service | Irrigated area | Gross crop value | |
| | Total | Per ir- rigated acre | | | Total | Per ir- rigated acre | | | Total | Per ir- rigated acre |
| Acres | Dollars | Dollars | Acres | Acres | Dollars | Dollars | Acres | Acres | Dollars | Dollars |
| | | | | | | | 69,300 | 34,939 | 5,197,880 | 148.77 |
| | | | | | | | 6,715 | 6,581 | 1,947,239 | 295.89 |
| | | | | | | | 1,985 | 1,985 | 207,508 | 104.54 |
| | | | | | | | 19,970 | 13,473 | 1,442,701 | 107.08 |
| | | | | | | | 28,670 | 22,039 | 3,597,448 | 163.23 |
| | | | | | | | 97,970 | 56,978 | 8,795,328 | 154.36 |
| | | | | | | | 239,581 | 177,988 | 59,203,483 | 332.63 |
| 276 | 9,193 | 33.31 | | | | | 600 | 276 | 9,193 | 33.31 |
| 2,262 | 390,329 | 172.56 | | | | | 2,262 | 2,262 | 390,329 | 172.56 |
| 513 | 42,336 | 82.53 | | | | | 2,992 | 513 | 42,336 | 82.53 |
| 1,080 | 65,160 | 60.33 | | | | | 1,080 | 1,080 | 65,160 | 60.33 |
| 36,193 | 7,796,264 | 215.41 | | | | | 38,014 | 36,193 | 7,796,264 | 215.41 |
| 29,704 | 10,406,315 | 350.33 | | | | | 39,425 | 29,704 | 10,406,315 | 350.33 |
| 5,633 | 1,462,562 | 259.64 | | | | | 9,304 | 5,633 | 1,462,562 | 259.64 |
| 1,980 | 187,300 | 94.60 | | | | | 2,031 | 1,980 | 187,300 | 94.60 |
| 77,641 | 20,359,459 | 262.23 | | | | | 95,708 | 77,641 | 20,359,459 | 262.23 |
| 77,641 | 20,359,459 | 262.23 | | | | | 335,289 | 255,629 | 79,562,942 | 311.24 |
| | | | | | | | 6,867 | 5,615 | 1,170,407 | 208.44 |
| | | | | | | | 7,743 | 3,845 | 939,360 | 244.31 |
| | | | | | | | 51,936 | 46,430 | 18,886,884 | 406.78 |
| | | | | | | | 66,546 | 55,890 | 20,996,651 | 375.68 |
| | | | | | | | 3,305 | 2,489 | 677,096 | 272.04 |
| | | | | | | | 118 | 108 | 44,899 | 415.73 |
| | | | | | | | 3,423 | 2,597 | 721,995 | 278.01 |
| 77,641 | 20,359,459 | 262.23 | | | | | 1,110,515 | 907,245 | 233,139,732 | 256.98 |
| 1,720 | 255,004 | 148.26 | | | | | 10,070 | 8,571 | 300,659 | 35.08 |
| | | | | | | | 2,662 | 1,720 | 255,004 | 148.26 |
| | | | | | | | 23,317 | 21,508 | 1,952,695 | 90.79 |
| | | | | | | | 10,027 | 7,246 | 2,073,661 | 286.18 |
| 7,730 | 1,920,319 | 248.42 | | | | | 7,730 | 7,730 | 1,920,319 | 248.42 |
| | | | | | | | 1,421 | 77 | 6,518 | 84.65 |
| 7,730 | 1,920,319 | 248.42 | | | | | 42,495 | 36,561 | 5,953,193 | 162.83 |
| 29,795 | 1,884,092 | 63.24 | | | | | 40,500 | 29,795 | 1,884,092 | 63.24 |
| 5,780 | 365,898 | 63.30 | | | | | 6,800 | 5,780 | 365,898 | 63.30 |
| 7,220 | 323,582 | 44.82 | | | | | 8,761 | 7,220 | 323,582 | 44.82 |
| 54,302 | 1,173,908 | 21.62 | | | | | 75,256 | 54,302 | 1,173,908 | 21.62 |

TABLE 1.—Irrigation and gross crop value data by States

| Region, project, division or reporting entity | State | Full irrigation service lands | | | | Supple- mental irrigation service lands |
|---|-------------------|----------------------------------|-------------------|------------------|----------------------------|---|
| | | Irrigable area for service | Irrigated area | Gross crop value |  |  | Irrigable area for service |
| | | | | Total | Per ir- rigated acre | |
| <i>Region 4—Continued</i> | | | | | | |
| Newlands: | | <i>Acres</i> | <i>Acres</i> | <i>Dollars</i> | <i>Dollars</i> | <i>Acres</i> |
| North Carson Division | Nevada | 8, 126 | 5, 290 | 319, 876 | 60. 47 | |
| South Carson Division | do. | 57, 166 | 44, 000 | 2, 281, 076 | 51. 84 | |
| Truckee Division | do. | 7, 078 | 5, 473 | 348, 196 | 63. 62 | |
| Totals, Newlands project | | 72, 370 | 54, 763 | 2, 949, 148 | 53. 85 | |
| Newton | Utah | | | | | 2, 200 |
| Ogden River | do. | | | | | 22, 867 |
| Paonia | Colorado | 11, 653 | 8, 900 | 730, 790 | 82. 11 | |
| Pine River | do. | | | | | 41, 193 |
| Pine River Indian Irrigation | do. | | | | | 9, 666 |
| Preston Bench | Idaho | | | | | 4, 500 |
| Provo River; Deer Creek Division | Utah | | | | | 46, 609 |
| Sanpete: | | | | | | |
| Ephraim Division | do. | | | | | 7, 630 |
| Spring City Division | do. | | | | | 6, 033 |
| Totals, Sanpete project | | | | | | 13, 663 |
| Scofield | Utah | | | | | 15, 609 |
| Strawberry Valley: | | | | | | |
| Highline Division | do. | 17, 635 | 15, 700 | 845, 203 | 53. 83 | |
| Spanish Fork Division | do. | | | | | 13, 693 |
| Springville-Mapleton Division | do. | | | | | 8, 611 |
| Totals, Strawberry Valley project. | | 17, 635 | 15, 700 | 845, 203 | 53. 83 | 22, 304 |
| Truckee Storage | Nevada-California | | | | | 28, 977 |
| Uncompahgre | Colorado | 89, 090 | 73, 987 | 5, 671, 204 | 76. 65 | |
| Weber River | Utah | | | | | 109, 032 |
| Totals, Region 4 | | 235, 583 | 190, 752 | 14, 529, 878 | 76. 17 | 458, 329 |
| <i>Region 5</i> | | | | | | |
| W. C. Austin | Oklahoma | 47, 809 | 39, 296 | 4, 967, 297 | 126. 41 | |
| Balmorhea | Texas | | | | | 10, 608 |
| Carlsbad | New Mexico | 25, 055 | 19, 606 | 4, 416, 796 | 225. 28 | |
| Fort Sumner | do. | 6, 500 | 5, 366 | 522, 264 | 97. 33 | |
| Middle Rio Grande | do. | 121, 680 | 53, 466 | 4, 845, 854 | 90. 63 | |
| Rio Grande: | | | | | | |
| Elephant Butte Irrigation District | do. | 102, 061 | 82, 110 | 22, 213, 161 | 270. 53 | |
| El Paso County Water Improvement District No. 1 | Texas | 75, 890 | 50, 245 | 14, 583, 282 | 290. 24 | |
| Hudspeth County Conservation and Reclamation District No. 1 | do. | | | | | 4 18, 330 |
| Totals, Rio Grande project | | 177, 951 | 132, 355 | 36, 796, 443 | 278. 01 | 4 18, 330 |
| Tucumcari | New Mexico | 42, 214 | 33, 140 | 2, 393, 249 | 72. 22 | |
| Vermejo | do. | 7, 379 | 4, 941 | 204, 929 | 41. 48 | |
| Totals, region 5 | | 428, 588 | 288, 170 | 54, 146, 832 | 187. 90 | 28, 938 |
| <i>Region 6</i> | | | | | | |
| Belle Fourche | South Dakota | 57, 182 | 53, 885 | 2, 480, 653 | 46. 04 | |
| Buffalo Rapids: | | | | | | |
| First Division | Montana | 13, 903 | 12, 356 | 722, 535 | 58. 48 | |
| Second Division | do. | 9, 422 | 8, 522 | 526, 960 | 61. 84 | |
| Totals, Buffalo Rapids project | | 23, 325 | 20, 878 | 1, 249, 495 | 59. 85 | |
| Buford-Trenton | North Dakota | 10, 510 | 8, 946 | 516, 370 | 57. 72 | |
| Huntley | Montana | 32, 487 | 24, 426 | 1, 576, 052 | 64. 52 | |
| Intake | do. | 881 | 737 | 18, 735 | 25. 42 | |

See footnotes at end of table.

for each project and reporting organization, 1956—Continued

| Supplemental irrigation service lands—Continued | | | Temporary irrigation service lands | | | | Total | | | |
|---|------------------|--------------------|------------------------------------|----------------|------------------|--------------------|----------------------------|----------------|------------------|--------------------|
| Irrigated area | Gross crop value | | Irrigable area for service | Irrigated area | Gross crop value | | Irrigable area for service | Irrigated area | Gross crop value | |
| | Total | Per irrigated acre | | | Total | Per irrigated acre | | | Total | Per irrigated acre |
| Acres | Dollars | Dollars | Acres | Acres | Dollars | Dollars | Acres | Acres | Dollars | Dollars |
| | | | | | | | 8, 126 | 5, 290 | 319, 876 | 60. 47 |
| | | | | | | | 57, 166 | 44, 000 | 2, 281, 076 | 51. 84 |
| | | | | | | | 7, 078 | 5, 473 | 348, 196 | 63. 62 |
| | | | | | | | | | | |
| | | | | | | | 72, 370 | 54, 763 | 2, 949, 148 | 53. 85 |
| 2, 116 | 122, 469 | 57. 88 | | | | | 2, 200 | 2, 116 | 122, 469 | 57. 88 |
| 15, 869 | 1, 906, 267 | 120. 13 | | | | | 22, 867 | 15, 869 | 1, 906, 267 | 120. 13 |
| | | | | | | | 11, 653 | 8, 900 | 730, 790 | 82. 11 |
| 37, 057 | 2, 015, 024 | 54. 38 | | | | | 41, 193 | 37, 057 | 2, 015, 024 | 54. 38 |
| 9, 666 | 349, 977 | 36. 21 | | | | | 9, 666 | 9, 666 | 349, 977 | 36. 21 |
| 3, 689 | 315, 490 | 85. 52 | | | | | 4, 500 | 3, 689 | 315, 490 | 85. 52 |
| 37, 540 | 3, 780, 174 | 100. 70 | | | | | 46, 609 | 37, 540 | 3, 780, 174 | 100. 70 |
| | | | | | | | | | | |
| | | | | | | | 7, 630 | 6, 664 | 237, 050 | 35. 57 |
| 6, 664 | 237, 050 | 35. 57 | | | | | 6, 033 | 4, 785 | 233, 400 | 48. 78 |
| 4, 785 | 233, 400 | 48. 78 | | | | | | | | |
| | | | | | | | 13, 663 | 11, 449 | 470, 450 | 41. 09 |
| 11, 449 | 470, 450 | 41. 09 | | | | | 15, 609 | 13, 348 | 715, 004 | 53. 57 |
| 13, 348 | 715, 004 | 53. 57 | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | 17, 635 | 15, 700 | 845, 203 | 53. 83 |
| 13, 290 | 1, 069, 868 | 80. 50 | 4, 107 | 4, 026 | 301, 775 | 74. 96 | 17, 800 | 17, 316 | 1, 371, 643 | 79. 21 |
| 7, 934 | 561, 866 | 70. 82 | | | | | 8, 611 | 7, 934 | 561, 866 | 70. 82 |
| | | | | | | | | | | |
| 21, 224 | 1, 631, 734 | 76. 88 | 4, 107 | 4, 026 | 301, 775 | 74. 96 | 44, 046 | 40, 950 | 2, 778, 712 | 67. 86 |
| 22, 446 | 1, 664, 202 | 74. 14 | | | | | 28, 977 | 22, 446 | 1, 664, 202 | 74. 14 |
| | | | | | | | | | | |
| | | | | | | | 89, 090 | 73, 987 | 5, 671, 204 | 76. 65 |
| 90, 941 | 8, 804, 350 | 96. 81 | | | | | 109, 032 | 90, 941 | 8, 804, 350 | 96. 81 |
| | | | | | | | | | | |
| 371, 892 | 27, 697, 944 | 74. 48 | 4, 107 | 4, 026 | 301, 775 | 74. 96 | 698, 019 | 566, 670 | 42, 529, 597 | 75. 05 |
| | | | | | | | | | | |
| | | | | | | | 47, 809 | 39, 296 | 4, 967, 297 | 126. 41 |
| 7, 700 | 1, 179, 506 | 153. 18 | | | | | 10, 608 | 7, 700 | 1, 179, 506 | 153. 18 |
| | | | | | | | 25, 055 | 19, 606 | 4, 416, 796 | 225. 28 |
| | | | | | | | 6, 500 | 5, 366 | 522, 264 | 97. 33 |
| | | | | | | | 121, 680 | 53, 466 | 4, 845, 854 | 90. 63 |
| | | | | | | | | | | |
| | | | | | | | 102, 061 | 82, 110 | 22, 213, 161 | 270. 53 |
| | | | | | | | 75, 890 | 50, 245 | 14, 583, 282 | 290. 24 |
| | | | | | | | | | | |
| 5, 180 | 1, 475, 454 | 284. 84 | | | | | 4 18, 330 | 5, 180 | 1, 475, 454 | 284. 84 |
| | | | | | | | | | | |
| 5, 180 | 1, 475, 454 | 284. 84 | | | | | 5 196, 281 | 137, 535 | 38, 271, 897 | 278. 27 |
| | | | | | | | 42, 214 | 33, 140 | 2, 393, 249 | 72. 22 |
| | | | | | | | 7, 379 | 4, 941 | 204, 929 | 41. 48 |
| | | | | | | | | | | |
| 12, 880 | 2, 654, 960 | 206. 13 | | | | | 457, 526 | 301, 050 | 56, 801, 792 | 188. 68 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | 57, 182 | 53, 885 | 2, 480, 653 | 46. 04 |
| | | | | | | | | | | |
| | | | 1, 243 | 1, 243 | 53, 534 | 43. 07 | 15, 146 | 13, 599 | 776, 069 | 57. 07 |
| | | | 950 | 950 | 46, 150 | 48. 58 | 10, 372 | 9, 472 | 573, 110 | 60. 51 |
| | | | | | | | | | | |
| | | | 2, 193 | 2, 193 | 99, 684 | 45. 46 | 25, 518 | 23, 071 | 1, 349, 179 | 58. 48 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | 10, 510 | 8, 946 | 516, 370 | 57. 72 |
| | | | | | | | 32, 487 | 24, 426 | 1, 576, 052 | 64. 52 |
| | | | | | | | 881 | 737 | 18, 735 | 25. 42 |

TABLE 1.—Irrigation and gross crop value data by States

| Region, project, division or reporting entity | State | Full irrigation service lands | | | | Supple- mental irrigation service lands |
|---|------------------|----------------------------------|-------------------|------------------|----------------------------|---|
| | | Irrigable area for service | Irrigated area | Gross crop value | | |
| | | | | Total | Per ir- rigated acre | Irrigable area for service |
| Region 6—Continued | | | | | | |
| Lower Yellowstone: | | Acres | Acres | Dollars | Dollars | Acres |
| District No. 1 | Montana | 36,866 | 32,591 | 2,327,440 | 71.41 | |
| District No. 2 | North Dakota | 19,405 | 16,740 | 1,109,035 | 66.25 | |
| Totals, Lower Yellowstone project. | | 56,271 | 49,331 | 3,436,475 | 69.66 | |
| Milk River: | | | | | | |
| Chinook Division | Montana | 43,484 | 27,760 | 1,643,965 | 59.22 | |
| Dodson Pumping Unit | do. | 1,147 | 961 | 52,827 | 54.97 | |
| Fort Belknap Indian Reservation | do. | 7,507 | 6,411 | 111,065 | 17.32 | |
| Glasgow Division | do. | 19,407 | 13,364 | 553,506 | 41.42 | |
| Malta Division | do. | 53,733 | 24,867 | 1,029,785 | 41.41 | |
| Private Pumpers | do. | 6,212 | 6,002 | 383,167 | 63.84 | |
| Totals, Milk River project. | | 131,490 | 79,365 | 3,774,315 | 47.56 | |
| Missouri River Basin: | | | | | | |
| Cheyenne Division: Angostura unit. | South Dakota | 12,154 | 10,500 | 582,655 | 55.49 | |
| Heart Division: | | | | | | |
| Dickinson unit | North Dakota | 338 | 338 | 18,842 | 55.75 | |
| Heart Butte unit | do. | 2,533 | 269 | 9,886 | 36.75 | |
| North Dakota Pumping Division: Fort Clark unit. | do. | 2,039 | 573 | 36,217 | 63.21 | |
| Three Forks Division: Crow Creek Pump unit. | Montana | 1,542 | 897 | 47,816 | 53.31 | |
| Yellowstone Division: Savage unit. | do. | 2,215 | 2,072 | 84,325 | 40.70 | |
| Rapid Valley | South Dakota | | | | | 8,900 |
| Riverton: | | | | | | |
| Midvale Irrigation District | Wyoming | 47,223 | 41,324 | 1,789,470 | 43.30 | |
| Third Division | do. | 8,585 | 7,644 | 240,679 | 31.49 | |
| Totals, Riverton project | | 55,808 | 48,968 | 2,030,149 | 41.46 | |
| Shoshone (Wyoming-Montana): | | | | | | |
| Frannie Division | Wyoming | 20,083 | 10,030 | 378,169 | 37.70 | |
| Garland Division | do. | 35,950 | 31,788 | 2,060,904 | 64.83 | |
| Heart Mountain Division | do. | 25,973 | 23,192 | 1,298,099 | 55.97 | |
| Willwood Division | do. | 11,590 | 9,691 | 634,125 | 65.43 | |
| Totals, Shoshone project | | 93,596 | 74,701 | 4,371,297 | 58.52 | |
| Sun River: | | | | | | |
| Fort Shaw Division | Montana | 10,522 | 9,809 | 245,329 | 25.01 | |
| Greenfields Division | do. | 83,502 | 57,158 | 2,217,271 | 38.79 | |
| Totals, Sun River project | | 94,024 | 66,967 | 2,462,600 | 36.77 | |
| Totals, Region 6 | | 576,395 | 442,853 | 22,695,882 | 51.25 | 8,900 |
| Region 7 | | | | | | |
| Colorado-Big Thompson | Colorado | | | | | 615,000 |
| Kendrick | Wyoming | 22,128 | 14,167 | 569,781 | 40.22 | |
| Mirage Flats | Nebraska | 11,657 | 11,235 | 1,122,941 | 99.95 | |
| Missouri River Basin: | | | | | | |
| Bostwick Division: Courtland unit. | Kansas | 10,100 | 5,347 | 404,812 | 75.71 | |
| Superior-Courtland unit | Nebraska | 21,009 | 14,567 | 1,301,399 | 89.34 | |
| Frenchman-Cambridge Division | do. | 22,507 | 17,265 | 1,710,144 | 99.05 | |
| Upper Republican Division: St. Francis unit. | Colorado-Kansas | | | | | 750 |
| North Platte (Nebraska-Wyoming): | | | | | | |
| Gering-Fort Laramie Irrigation District | Nebraska | 54,845 | 53,302 | 6,413,400 | 120.32 | |
| Goshen Irrigation District | Wyoming | 52,484 | 51,590 | 4,399,383 | 85.28 | |
| Northport Irrigation District | Nebraska | 16,170 | 13,022 | 809,940 | 62.20 | |
| Pathfinder Irrigation District | Nebraska-Wyoming | 102,824 | 91,342 | 7,130,566 | 78.06 | |

See footnotes at end of table.

for each project and reporting organization, 1956—Continued

| Supplemental irrigation service lands—Continued | | | Temporary irrigation service lands | | | | Total | | | |
|---|------------------|--------------------|------------------------------------|----------------|------------------|--------------------|----------------------------|----------------|------------------|--------------------|
| Irrigated area | Gross crop value | | Irrigable area for service | Irrigated area | Gross crop value | | Irrigable area for service | Irrigated area | Gross crop value | |
| | Total | Per irrigated acre | | | Total | Per irrigated acre | | | Total | Per irrigated acre |
| Acres | Dollars | Dollars | Acres | Acres | Dollars | Dollars | Acres | Acres | Dollars | Dollars |
| | | | 974 | 974 | 54,207 | 55.65 | 37,840 | 33,565 | 2,381,647 | 70.96 |
| | | | 73 | 73 | 4,080 | 55.89 | 19,478 | 16,813 | 1,113,115 | 66.21 |
| | | | 1,047 | 1,047 | 58,287 | 55.67 | 57,318 | 50,378 | 3,494,762 | 69.37 |
| | | | | | | | | | | |
| | | | | | | | 43,484 | 27,760 | 1,643,965 | 59.22 |
| | | | | | | | 1,147 | 961 | 52,827 | 54.97 |
| | | | | | | | 7,507 | 6,411 | 111,065 | 17.32 |
| | | | | | | | 19,407 | 13,364 | 553,506 | 41.42 |
| | | | | | | | 53,733 | 24,867 | 1,029,785 | 41.41 |
| | | | | | | | 6,212 | 6,002 | 383,167 | 63.84 |
| | | | | | | | 131,490 | 79,365 | 3,774,315 | 47.56 |
| | | | | | | | | | | |
| | | | 220 | 220 | 11,920 | 54.18 | 12,374 | 10,720 | 594,575 | 55.46 |
| | | | | | | | 338 | 338 | 18,842 | 55.75 |
| | | | | | | | 2,533 | 269 | 9,886 | 36.75 |
| | | | | | | | 2,039 | 573 | 36,217 | 63.21 |
| | | | | | | | 1,542 | 897 | 47,816 | 53.31 |
| | | | | | | | 2,215 | 2,072 | 84,325 | 40.70 |
| 7,310 | 241,749 | 33.07 | | | | | 8,900 | 7,310 | 241,749 | 33.07 |
| | | | | | | | | | | |
| | | | 2,183 | 2,183 | 86,343 | 39.55 | 49,406 | 43,507 | 1,875,813 | 43.12 |
| | | | 6,198 | 6,198 | 188,952 | 30.49 | 14,783 | 13,842 | 429,631 | 31.04 |
| | | | 8,381 | 8,381 | 275,295 | 32.85 | 64,189 | 57,349 | 2,305,444 | 40.20 |
| | | | | | | | | | | |
| | | | | | | | 20,083 | 10,030 | 378,169 | 37.70 |
| | | | | | | | 35,950 | 31,788 | 2,060,904 | 64.83 |
| | | | | | | | 25,973 | 23,192 | 1,298,099 | 55.97 |
| | | | | | | | 11,590 | 9,691 | 634,125 | 65.43 |
| | | | | | | | 93,596 | 74,701 | 4,371,297 | 58.52 |
| | | | | | | | | | | |
| | | | | | | | 10,522 | 9,809 | 245,329 | 25.01 |
| | | | | | | | 83,502 | 57,158 | 2,217,271 | 38.79 |
| | | | | | | | 94,024 | 66,967 | 2,462,600 | 36.77 |
| 7,310 | 241,749 | 33.07 | 11,841 | 11,841 | 445,186 | 37.60 | 597,136 | 462,004 | 23,382,817 | 50.61 |
| | | | | | | | | | | |
| 615,000 | 65,518,329 | 106.53 | | | | | 615,000 | 615,000 | 65,518,329 | 106.53 |
| | | | | | | | 22,128 | 14,167 | 569,781 | 40.22 |
| | | | | | | | 11,657 | 11,235 | 1,122,941 | 99.95 |
| | | | | | | | 10,100 | 5,347 | 404,812 | 75.71 |
| | | | | | | | 21,009 | 14,567 | 1,301,399 | 89.34 |
| 734 | 23,536 | 32.07 | | | | | 22,507 | 17,265 | 1,710,144 | 99.05 |
| | | | | | | | 750 | 734 | 23,536 | 32.07 |
| | | | | | | | | | | |
| | | | | | | | 54,845 | 53,302 | 6,413,400 | 120.32 |
| | | | | | | | 52,484 | 51,590 | 4,399,383 | 85.28 |
| | | | | | | | 16,170 | 13,022 | 8,809,940 | 62.20 |
| | | | | | | | 6 102,824 | 91,342 | 7,130,566 | 78.06 |

TABLE 1.—Irrigation and gross crop value data by States

| Region, project, division or reporting entity | State | Full irrigation service lands | | | | Supple- mental irrigation service lands |
|---|---------------|----------------------------------|-------------------|------------------|----------------------------|---|
| | | Irrigable area for service | Irrigated area | Gross crop value | | Irrigable area for service |
| | | | | Total | Per ir- rigated acre | |
| <i>Region 7—Continued</i> | | | | | | |
| North Platte—Continued | | | | | | |
| Warren Act contractors: | | <i>Acres</i> | <i>Acres</i> | <i>Dollars</i> | <i>Dollars</i> | <i>Acres</i> |
| Beerline Canal Company..... | Nebraska..... | | | | | 1,003 |
| Brown's Creek Irrigation Dis- trict..... | do..... | | | | | 6,054 |
| Central Irrigation District..... | do..... | | | | | 2,127 |
| Chimney Rock Irrigation Dis- trict..... | do..... | | | | | 5,636 |
| Farmers' Irrigation District..... | do..... | | | | | 63,324 |
| Gering Irrigation District..... | do..... | | | | | 14,254 |
| Lingle Water Users and Hill District..... | Wyoming..... | | | | | 15,367 |
| Rock Ranch Ditch Co..... | do..... | | | | | 950 |
| Leased and Water Rental Lands..... | Nebraska..... | | | | | |
| Totals, North Platte project..... | | 226,323 | 209,256 | 18,753,289 | 89.62 | 108,715 |
| Totals, Region 7..... | | 313,724 | 271,837 | 23,862,366 | 87.78 | 724,465 |
| Grand totals, all regions, all projects..... | | 4,154,499 | 3,323,341 | 496,814,975 | 149.49 | 3,422,078 |

¹ Includes 819 acres of nonirrigable lands irrigated from wasteways and water allotted to irrigable lands.² Districts irrigated in 1954 but not reported in 1956.³ Districts irrigated in 1955 but not reported in 1956.⁴ Area for which service is available under Warren Act Contract.⁵ Includes 18,330 acres for which service is available under Warren Act Contract.⁶ Of this irrigable acreage for service, 100,949 acres are in Nebraska and 1,875 acres are in Wyoming.

for each project and reporting organization, 1956—Continued

| Supplemental irrigation service lands—Continued | | | Temporary irrigation service lands | | | | Total | | | |
|--|------------------|----------------------------|---------------------------------------|------------------------|------------------|----------------------------|----------------------------------|-------------------|------------------|----------------------------|
| Irrigated area | Gross crop value | | Irrig- able area for service | Irrig- ated area | Gross crop value | | Irrigable area for service | Irrigated area | Gross crop value | |
| | Total | Per ir- rigated acre | | | Total | Per ir- rigated acre | | | Total | Per ir- rigated acre |
| <i>Acres</i> | <i>Dollars</i> | <i>Dollars</i> | <i>Acres</i> | <i>Acres</i> | <i>Dollars</i> | <i>Dollars</i> | <i>Acres</i> | <i>Acres</i> | <i>Dollars</i> | <i>Dollars</i> |
| 1,003 | 33,593 | 33.49 | | | | | 1,003 | 1,003 | 33,593 | 33.49 |
| 6,054 | 236,975 | 39.14 | | | | | 6,054 | 6,054 | 236,975 | 39.14 |
| 2,120 | 213,048 | 100.49 | | | | | 2,127 | 2,120 | 213,048 | 100.49 |
| 5,000 | 216,965 | 43.39 | | | | | 5,636 | 5,000 | 216,965 | 43.39 |
| 62,334 | 7,937,194 | 127.33 | | | | | 63,324 | 62,334 | 7,937,194 | 127.33 |
| 13,725 | 1,525,253 | 111.13 | | | | | 14,254 | 13,725 | 1,525,253 | 111.13 |
| 13,886 | 966,010 | 69.57 | | | | | 15,367 | 13,886 | 966,010 | 69.57 |
| 950 | 77,850 | 81.95 | | | | | 950 | 950 | 77,850 | 81.95 |
| | | | 22,366 | | | | 22,366 | | | |
| 105,072 | 11,206,888 | 106.66 | 22,366 | | | | 357,404 | 314,328 | 29,960,177 | 95.32 |
| 720,806 | 76,748,753 | 106.48 | 22,366 | | | | 1,060,555 | 992,643 | 100,611,119 | 101.36 |
| 3,022,541 | 448,153,993 | 148.27 | 82,224 | 54,261 | 6,654,688 | 122.64 | 7,658,801 | 6,400,143 | 951,622,656 | 148.69 |

| | | | | | | | | | | |
|------------|--|---------|------------|---------|------------|-------|---------|-----------|-------------|--------|
| Kansas | Minidoka | 213,447 | 18,406,588 | 808,133 | 66,949,157 | 509 | 50,824 | 1,022,089 | 85,406,569 | 83.56 |
| | Owyhee (see also Oregon) | 31,286 | 3,480,616 | | 315,490 | | | 31,286 | 3,480,616 | 111.25 |
| | Preston Bench | | | 3,689 | | | | 3,689 | 3,315,490 | 85.52 |
| | Rathdrum Prairie | 3,488 | 323,658 | | | | | 3,488 | 323,658 | 92.79 |
| | Subtotals | 451,312 | 41,912,315 | 935,627 | 82,078,536 | 509 | 50,824 | 1,387,448 | 124,041,675 | 89.40 |
| | Missouri River Basin: | | | | | | | | | |
| | Bostwick Division: Courtland unit | 5,347 | 404,812 | | | | | 5,347 | 404,812 | 75.71 |
| | Montana | | | | | | | | | |
| | Bitter Root | 16,340 | 588,779 | | | | | 16,340 | 588,779 | 36.03 |
| | Buffalo Rapids | 20,878 | 1,249,495 | | | 2,193 | 99,684 | 23,071 | 1,349,179 | 58.48 |
| Nebraska | Frenchtown | 3,802 | 3,802 | | | | | 3,802 | 217,039 | 57.09 |
| | Huntley | 24,426 | 1,576,052 | | | | | 24,426 | 1,576,052 | 64.52 |
| | Intake | 737 | 18,735 | | | | | 737 | 18,735 | 25.42 |
| | Lower Yellowstone (see also North Dakota) | 32,591 | 2,327,440 | | | 974 | 54,207 | 33,565 | 2,381,647 | 70.96 |
| | Milk River | 79,365 | 3,774,315 | | | | | 79,365 | 3,774,315 | 47.56 |
| | Missoula Valley | 768 | 29,093 | | | | | 768 | 29,093 | 37.88 |
| | Missouri River Basin: | | | | | | | | | |
| | Three Forks Division: Crow Creek pump unit | 897 | 47,816 | | | | | 897 | 47,816 | 53.31 |
| | Yellowstone Division: Savage unit | 2,072 | 84,325 | | | | | 2,072 | 84,325 | 40.70 |
| | Sum River | 66,967 | 2,462,600 | | | | | 66,967 | 2,462,600 | 36.77 |
| Nevada | Subtotals | 248,843 | 12,375,689 | | | 3,167 | 153,891 | 252,010 | 12,529,580 | 49.72 |
| | Mirage Flats | | | | | | | | | |
| | Missouri River Basin: | 11,235 | 1,122,941 | | | | | 11,235 | 1,122,941 | 99.95 |
| | Bostwick Division: Superior-Courtland unit | 14,567 | 1,301,399 | | | | | 14,567 | 1,301,399 | 89.34 |
| | Frenchman-Cambridge Division | 17,265 | 1,710,144 | | | | | 17,265 | 1,710,144 | 99.05 |
| | North Platte (see also Wyoming) | 157,666 | 14,353,906 | 90,236 | 10,163,028 | | | 247,902 | 24,516,934 | 98.90 |
| | Subtotals | 200,733 | 18,488,390 | 90,236 | 10,163,028 | | | 290,969 | 28,651,418 | 98.47 |
| | Humboldt | | | | | | | | | |
| | Needlands | 54,763 | 2,949,148 | 29,795 | 1,881,092 | | | 29,795 | 1,884,092 | 63.24 |
| | Truckee Storage | | | 22,446 | 1,664,202 | | | 22,446 | 1,664,202 | 53.85 |
| New Mexico | Subtotals | 54,763 | 2,949,148 | 52,241 | 3,548,294 | | | 107,004 | 6,497,442 | 74.14 |
| | Carlsbad | | | | | | | | | |
| | Fort Sumner | 19,606 | 4,416,796 | | | | | 19,606 | 4,416,796 | 225.28 |
| | Middle Rio Grande | 5,366 | 5,522,264 | | | | | 5,366 | 5,522,264 | 97.33 |
| | Rio Grande (see also Texas) | 53,406 | 4,845,854 | | | | | 53,406 | 4,845,854 | 90.63 |
| | Tucumcari | 82,110 | 22,213,161 | | | | | 82,110 | 22,213,161 | 270.53 |
| | Vermelo | 33,140 | 2,393,249 | | | | | 33,140 | 2,393,249 | 72.22 |
| | | 4,941 | 204,929 | | | | | 4,941 | 204,929 | 41.48 |
| | Subtotals | 198,629 | 34,596,253 | | | | | 198,629 | 34,596,253 | 174.18 |

TABLE 2.—*Irrigation and gross crop value data by type of irrigation service for each State, 1956—Continued*

| State | Project and division | Full irrigation service | | Supplemental irrigation service | | Temporary irrigation service | | Total | | |
|--------------|--|-------------------------|------------------|---------------------------------|------------------|------------------------------|------------------|------------------|------------|----------------------------|
| | | Irrigated area | Gross crop value | Irrigated area | Gross crop value | Irrigated area | Gross crop value | Gross crop value | | Average per acre irrigated |
| | | | | | | | | Total | Dollars | |
| North Dakota | Buford-Trenton | Acres | Dollars | Acres | Dollars | Acres | Dollars | Acres | Dollars | Dollars |
| | Lower Yellowstone (see also Montana) | 8,946 | 516,370 | | | | | 8,946 | 516,370 | 57.72 |
| | Missouri River Basin: | 16,740 | 1,109,035 | | | 73 | 4,080 | 16,813 | 1,113,115 | 66.21 |
| | Heart Division: | | | | | | | | | |
| | Dickinson unit | 338 | 18,842 | | | | | 338 | 18,842 | 55.75 |
| Oklahoma | Heart Butte unit | 269 | 9,886 | | | | | 269 | 9,886 | 36.75 |
| | North Dakota Pumping Division: Fort Clark unit | 573 | 36,217 | | | | | 573 | 36,217 | 63.21 |
| | Subtotals | 26,866 | 1,690,350 | | | 73 | 4,080 | 26,939 | 1,694,430 | 62.90 |
| | W. C. Austin | 39,296 | 4,967,297 | | | | | 39,296 | 4,967,297 | 126.41 |
| | | 2,891 | 119,639 | | | | | 2,891 | 119,639 | 41.38 |
| Oregon | Arnold | | | | | | | 7,305 | 375,876 | 51.45 |
| | Baker | 1,450 | 84,771 | 7,305 | | | | 1,450 | 84,771 | 58.46 |
| | Boise (see also Idaho) | | | 15,115 | | | | 15,115 | 649,568 | 42.98 |
| | Burnt River | 6,178 | 297,595 | | | | | 6,178 | 297,595 | 48.17 |
| | Crescent Lake Dam | 46,951 | 6,014,045 | 46,001 | 3,429,313 | 819 | 58,759 | 93,771 | 9,502,117 | 101.33 |
| | Deschutes | 7,378 | 910,119 | | | | | 7,378 | 910,119 | 123.36 |
| | Grants Pass | 116,732 | 11,283,009 | | | | | 116,732 | 11,283,009 | 96.66 |
| | Klamath (see also California) | 8,333 | 651,145 | | | | | 8,333 | 651,145 | 78.14 |
| | Ochoco | 8,333 | 3,436,099 | | | | | 8,333 | 3,436,099 | 166.24 |
| | Owyhee (see also Idaho) | 12,809 | 4,410,132 | 12,860 | | | | 12,809 | 4,410,132 | 344.30 |
| | Rogue River Basin | 67,694 | 9,955,077 | 12,809 | | | | 67,694 | 9,955,077 | 148.87 |
| | Umatilla | 12,123 | 628,597 | 10,922 | 1,291,645 | 503 | 78,273 | 23,548 | 1,998,515 | 84.87 |
| | Vale | 31,594 | 2,192,167 | | | | | 31,594 | 2,192,167 | 69.39 |
| | Subtotals | 301,324 | 32,136,164 | 105,012 | 13,592,633 | 1,322 | 137,032 | 407,658 | 45,865,829 | 112.51 |
| South Dakota | Belle Fourche | 53,885 | 2,480,653 | | | | | 53,885 | 2,480,653 | 46.04 |
| | Missouri River Basin: | | | | | | | | | |
| | Cheyenne Division: Angostura unit | 10,500 | 582,655 | | | 220 | 11,920 | 10,720 | 594,575 | 55.46 |
| | Rapid Valley | | | 7,310 | 241,749 | | | 7,310 | 241,749 | 33.07 |
| | Subtotals | 64,385 | 3,063,308 | 7,310 | 241,749 | 220 | 11,920 | 71,915 | 3,316,977 | 46.12 |

| | | | | | | | | | |
|------------|----------------------------------|-----------|-------------|-----------|-------------|--------|-----------|-------------|--------|
| Texas | Balmorhea | 50,245 | 14,583,282 | 7,700 | 1,179,506 | | 7,700 | 1,179,506 | 153.18 |
| | Rio Grande (see also New Mexico) | | | 5,180 | 1,475,454 | | 55,425 | 16,058,736 | 289.74 |
| Utah | Subtotals | 50,245 | 14,583,282 | 12,880 | 2,654,960 | | 63,125 | 17,238,242 | 273.08 |
| | Hyrum | | | 5,780 | 365,898 | | 5,780 | 365,898 | 63.30 |
| | Moon Lake | | | 54,302 | 1,173,908 | | 54,302 | 1,173,908 | 21.62 |
| | Newton | | | 12,116 | 1,122,469 | | 2,116 | 122,469 | 57.88 |
| | Ogden River | | | 15,869 | 1,906,267 | | 15,869 | 1,906,267 | 120.13 |
| | Provo River | | | 37,540 | 3,780,174 | | 37,540 | 3,780,174 | 100.70 |
| | Sanpote | | | 11,449 | 470,450 | | 11,449 | 470,450 | 41.09 |
| | Sciofield | | | 13,348 | 715,004 | | 13,348 | 715,004 | 53.57 |
| | Strawberry Valley | 15,700 | 845,203 | 21,224 | 1,631,734 | 4,026 | 40,950 | 2,778,712 | 67.86 |
| | Weber River | | | 90,941 | 8,804,350 | | 90,941 | 8,804,350 | 96.81 |
| | Subtotals | 15,700 | 845,203 | 252,569 | 18,970,254 | 4,026 | 272,295 | 20,117,232 | 73.88 |
| | Columbia Basin | | | | | | 174,788 | 22,413,081 | 128.23 |
| Washington | Okanogan | 174,788 | 22,413,081 | | | | 3,972 | 650,545 | 163.78 |
| | Yakima | 227,130 | 51,326,051 | 163,530 | 35,414,318 | 194 | 390,8548 | 6,768,089 | 222.00 |
| | Subtotals | 405,890 | 74,389,677 | 163,530 | 35,414,318 | 194 | 569,614 | 109,831,715 | 192.82 |
| Wyoming | Eden | | | | | | | | |
| | Kendrick | 8,571 | 300,659 | | | | 8,571 | 300,659 | 35.08 |
| | North Platte (see also Nebraska) | 14,167 | 569,781 | | | | 14,167 | 569,781 | 40.22 |
| | Riverton | 51,590 | 4,399,383 | 14,836 | 1,043,860 | | 66,426 | 5,443,243 | 81.94 |
| | Shoshone | 48,968 | 2,030,149 | | | 8,381 | 57,349 | 2,305,444 | 40.20 |
| | Subtotals | 74,701 | 4,371,297 | | | | 74,701 | 4,371,097 | 58.52 |
| | Grand totals, all States | 197,997 | 11,671,269 | 14,836 | 1,043,860 | 8,381 | 221,214 | 12,990,424 | 58.72 |
| | | 3,323,341 | 496,814,975 | 3,022,541 | 448,153,943 | 54,261 | 6,400,143 | 951,623,056 | 148.69 |

TABLE 3. *Acreage, production, and gross crop value by crops and types of crops 1956*

| Crops | Irrigated lands | | Tonnage | | Gross crop value | |
|----------------------------------|-----------------|------------------|-------------|------------------|------------------|-------------------------------|
| | Total | Percent of total | Total | Percent of total | Total | Percent of total ¹ |
| Cereals: | <i>Acres</i> | <i>Percent</i> | <i>Tons</i> | <i>Percent</i> | <i>Dollars</i> | <i>Percent</i> |
| Barley... | 534,700 | 8.35 | 683,427 | 2.41 | 29,985,079 | 3.15 |
| Corn | 225,586 | 3.52 | 390,065 | 1.37 | 20,428,856 | 2.15 |
| Oats | 196,467 | 3.07 | 166,722 | .59 | 7,778,894 | .82 |
| Rice | 8,650 | .14 | 15,007 | .05 | 1,912,364 | .20 |
| Rye | 2,957 | .05 | 2,364 | .01 | 124,661 | .01 |
| Sorghums | 90,029 | 1.41 | 112,440 | .40 | 5,554,336 | .58 |
| Wheat | 440,408 | 6.88 | 591,281 | 2.08 | 34,618,601 | 3.64 |
| Other | 62,097 | .97 | 84,158 | .30 | 3,337,534 | .35 |
| Subtotals | 1,560,894 | 24.39 | 2,045,464 | 7.21 | 103,740,325 | 10.90 |
| Forage: | | | | | | |
| Alfalfa hay | 1,612,128 | 25.19 | 5,833,129 | 20.55 | 121,820,769 | 12.80 |
| Other hay | 224,108 | 3.50 | 462,126 | 1.63 | 8,456,898 | .89 |
| Irrigated pasture | 967,077 | 15.11 | 2,585,835 | 9.11 | 30,122,072 | 3.16 |
| Corn fodder | 9,669 | .15 | 74,821 | .26 | 500,047 | .05 |
| Silage or ensilage | 158,457 | 2.48 | 1,850,324 | 6.52 | 14,323,757 | 1.51 |
| Crop residue: Beet tops | | | 2,005,875 | 7.07 | 1,488,814 | .16 |
| Stubble, stalks, etc. | | | 192,665 | .68 | 1,343,597 | .14 |
| Straw | | | 220,210 | .77 | 1,229,233 | .13 |
| Root crops | 63 | | 409 | | 2,190 | |
| Other forage | 29,521 | .46 | 96,223 | .34 | 1,527,408 | .16 |
| Subtotals | 3,001,023 | 46.89 | 13,321,617 | 46.93 | 180,814,785 | 19.00 |
| Miscellaneous field crops: | | | | | | |
| Beans, castor | 430 | .01 | 381 | | 55,103 | .01 |
| Beans, dry and edible | 286,871 | 4.48 | 237,170 | .84 | 27,735,480 | 2.91 |
| Broomcorn | 4,325 | .07 | 1,139 | .01 | 367,316 | .04 |
| Cotton, lint (upland) | 417,757 | 6.53 | 193,779 | .68 | 132,988,752 | 13.97 |
| Cotton, seed (upland) | | | 302,080 | 1.06 | 18,834,832 | 1.98 |
| Cotton, lint (American-Egyptian) | 20,032 | .31 | 5,220 | .02 | 6,553,332 | .69 |
| Cotton, seed (American-Egyptian) | | | 9,680 | .03 | 667,254 | .07 |
| Hops | 14,254 | .22 | 12,421 | .04 | 10,062,880 | 1.06 |
| Peppermint | 10,154 | .16 | 394 | | 3,107,120 | .33 |
| Spearmint | 3,028 | .05 | 120 | | 848,360 | .09 |
| Sugar beets | 351,662 | 5.49 | 6,233,271 | 21.96 | 63,201,664 | 6.64 |
| Other miscellaneous field crops | 6,665 | .10 | 19,893 | .07 | 780,637 | .08 |
| Subtotals | 1,115,178 | 17.42 | 7,015,548 | 24.71 | 265,202,730 | 27.87 |
| Vegetables: | | | | | | |
| Asparagus | 11,558 | .18 | 19,934 | .07 | 4,321,062 | .45 |
| Beans (processing) | 7,056 | .11 | 14,436 | .05 | 1,688,235 | .18 |
| Beans (fresh market) | 1,677 | .03 | 5,322 | .02 | 958,733 | .10 |
| Broccoli | 759 | .01 | 3,262 | .01 | 337,296 | .04 |
| Cabbage | 2,760 | .04 | 38,826 | .14 | 814,088 | .09 |
| Carrots | 10,376 | .16 | 116,527 | .41 | 9,927,404 | 1.04 |
| Cauliflower | 7 | | 53 | | 3,677 | |
| Celery | 283 | | 6,520 | .02 | 388,976 | .04 |
| Corn, sweet (processing) | 20,215 | .32 | 105,715 | .37 | 2,339,504 | .25 |
| Corn, sweet (fresh market) | 6,041 | .09 | 15,531 | .05 | 1,547,816 | .16 |
| Cucumbers | 1,938 | .03 | 9,681 | .03 | 656,998 | .07 |
| Greens (kale, etc.) | 415 | .01 | 2,490 | .01 | 174,300 | .02 |
| Lettuce | 58,543 | .92 | 433,425 | 1.53 | 32,555,177 | 3.42 |
| Melons: Cantaloupes, etc. | 32,968 | .52 | 147,131 | .52 | 13,311,360 | 1.40 |
| Honey Ball, honeydew, etc. | 4,780 | .07 | 50,092 | .18 | 2,644,037 | .28 |
| Watermelons | 9,264 | .14 | 65,154 | .23 | 2,573,573 | .27 |
| Onions, dry | 9,944 | .15 | 155,844 | .55 | 5,813,507 | .61 |
| Onions, green | 571 | .01 | 1,364 | .01 | 168,350 | .02 |
| Peas, green (processing) | 16,198 | .25 | 26,689 | .09 | 2,207,699 | .23 |
| Peas, green (fresh market) | 1,683 | .03 | 3,709 | .01 | 828,210 | .09 |
| Peppers | 2,933 | .05 | 10,618 | .04 | 2,331,671 | .24 |
| Potatoes, early | 39,526 | .62 | 488,897 | 1.72 | 27,615,180 | 2.90 |
| Potatoes, late | 182,526 | 2.85 | 1,829,103 | 6.44 | 41,772,467 | 4.39 |
| Squash | 2,997 | .05 | 9,217 | .03 | 1,141,923 | .12 |
| Sweet potatoes | 658 | .01 | 2,420 | .01 | 250,147 | .03 |
| Tomatoes (canning) | 23,484 | .37 | 316,381 | 1.12 | 7,505,447 | .79 |
| Tomatoes (fresh market) | 10,583 | .17 | 86,840 | .31 | 12,752,795 | 1.34 |
| Other vegetables | 6,719 | .10 | 46,321 | .16 | 2,531,004 | .26 |
| Subtotals | 466,518 | 7.29 | 4,011,502 | 14.13 | 179,160,636 | 18.83 |
| Total nursery | 3,219 | .05 | | | 5,303,844 | .56 |

TABLE 3.—*Acreage, production, and gross crop value by crops and types of crops 1956—Continued*

| Crops | Irrigated lands | | Tonnage | | Gross crop value | |
|---|-----------------|------------------|-------------|------------------|------------------|-------------------------------|
| | Total | Percent of total | Total | Percent of total | Total | Percent of total ¹ |
| Seeds: | <i>Acres</i> | <i>Percent</i> | <i>Tons</i> | <i>Percent</i> | <i>Dollars</i> | <i>Percent</i> |
| Alfalfa..... | 112,732 | 1.76 | 20,387 | 0.07 | 11,820,792 | 1.24 |
| Clover..... | 39,438 | .62 | 7,331 | .03 | 4,538,423 | .48 |
| Corn..... | 6,278 | .10 | 7,882 | .03 | 1,071,348 | .11 |
| Flaxseed..... | 43,331 | .68 | 28,341 | .10 | 3,580,558 | .38 |
| Grass..... | 12,088 | .19 | 2,606 | .01 | 1,957,787 | .21 |
| Lettuce..... | 1,550 | .02 | 182 | ..... | 306,743 | .03 |
| Onion..... | 664 | .01 | 156 | ..... | 225,296 | .02 |
| Pea..... | 50,746 | .79 | 48,034 | .17 | 4,604,343 | .48 |
| Potato..... | 540 | .01 | 7,180 | .03 | 423,198 | .04 |
| Sugar beet..... | 2,115 | .03 | 3,119 | .01 | 928,215 | .10 |
| Other seed..... | 8,716 | .14 | 6,590 | .02 | 1,291,897 | .14 |
| Subtotal..... | 278,198 | 4.35 | 131,808 | .47 | 30,748,600 | 3.23 |
| Fruits: | | | | | | |
| Apples..... | 39,910 | .62 | 294,800 | 1.04 | 30,536,925 | 3.21 |
| Apricots..... | 5,236 | .08 | 26,748 | .09 | 3,100,330 | .33 |
| Berries..... | 1,712 | .03 | 2,915 | .01 | 1,189,613 | .12 |
| Cherries..... | 5,348 | .08 | 9,582 | .03 | 2,280,619 | .24 |
| Citrus: | | | | | | |
| Grapefruit..... | 12,230 | .19 | 174,813 | .62 | 6,620,851 | .69 |
| Lemons and limes..... | 9,326 | .15 | 81,220 | .29 | 6,368,115 | .67 |
| Oranges and tangerines..... | 28,705 | .45 | 270,433 | .95 | 20,993,213 | 2.21 |
| Dates..... | 4,264 | .07 | 16,805 | .06 | 6,060,841 | .64 |
| Grapes, table..... | 50,658 | .79 | 315,014 | 1.11 | 28,707,219 | 3.02 |
| Grapes, other..... | 31,406 | .49 | 250,744 | .88 | 11,975,120 | 1.26 |
| Olives..... | 8,057 | .12 | 21,656 | .08 | 4,220,992 | .44 |
| Peaches..... | 26,298 | .41 | 153,681 | .54 | 11,736,398 | 1.23 |
| Pears..... | 22,382 | .35 | 177,987 | .63 | 12,605,033 | 1.32 |
| Prunes and plums..... | 8,721 | .14 | 47,217 | .17 | 3,558,928 | .37 |
| Other fruits..... | 3,107 | .05 | 6,098 | .02 | 1,031,273 | .11 |
| Subtotals..... | 257,360 | 4.02 | 1,849,713 | 6.52 | 150,985,470 | 15.86 |
| Nuts: | | | | | | |
| Almonds..... | 5,398 | .09 | 2,475 | .01 | 1,993,340 | .21 |
| Pecans..... | 4,475 | .07 | 2,501 | .01 | 1,612,022 | .17 |
| Walnuts..... | 5,937 | .09 | 4,152 | .01 | 2,222,388 | .23 |
| Other nuts..... | 94 | ..... | 74 | ..... | 53,110 | .01 |
| Subtotals..... | 15,904 | .25 | 9,202 | .03 | 5,880,860 | .62 |
| Family gardens and orchards..... | 19,336 | .30 | ..... | ..... | 3,660,941 | .38 |
| Total, all crops..... | 6,717,630 | 104.96 | 28,384,854 | 100.00 | 925,498,191 | 97.25 |
| Less multiple cropped..... | 453,778 | 7.09 | ..... | ..... | ..... | ..... |
| Total harvested cropland and pasture..... | 6,263,852 | 97.87 | ..... | ..... | ..... | ..... |
| Cropland not harvested..... | 121,668 | 1.90 | ..... | ..... | ..... | ..... |
| Soil building..... | 14,623 | .23 | ..... | ..... | ..... | ..... |
| Acres irrigated..... | 6,400,143 | 100.00 | ..... | ..... | ..... | ..... |
| Additional revenues ²..... | ..... | ..... | ..... | ..... | 26,125,465 | 2.75 |
| Total gross crop value..... | ..... | ..... | ..... | ..... | 951,623,656 | 100.00 |
| Full irrigation service..... | 3,323,341 | ..... | ..... | ..... | 496,814,975 | ..... |
| Supplemental irrigation service..... | 3,022,541 | ..... | ..... | ..... | 448,153,993 | ..... |
| Temporary irrigation service..... | 51,261 | ..... | ..... | ..... | 6,654,688 | ..... |

¹ Additional revenues are included in computing percentages.² Includes payments received from Federal and commercial agencies.

TABLE 4.—*Repayment contracts—matured and unmatured, June 30, 1957*

| Project and State | Value of repayment contracts | | | Unmatured value of repayment contracts | | | | Matured value of repayment contracts | Amount due and unpaid |
|---|------------------------------|-------------------------------|---------------|--|------------------|-------------------------------|---------------|--------------------------------------|-----------------------|
| | Construction | Rehabilitation and betterment | Total | Construction | Deferred charges | Rehabilitation and betterment | Total | | |
| PROPERTY TITLED IN UNITED STATES | | | | | | | | | |
| Avondale, Idaho | \$244,423.61 | | \$244,423.61 | \$244,423.61 | | | \$244,423.61 | \$572,523.49 | |
| W. C. Austin, Oklahoma | 3,262,188.49 | | 3,262,188.49 | 2,689,065.00 | | | 2,689,065.00 | 118,275.95 | |
| Baker, Oregon | 225,014.54 | | 225,014.54 | 86,545.34 | \$20,193.25 | | 106,738.59 | 21,200.50 | |
| Balmorhea, Texas | 255,600.00 | | 255,600.00 | 231,399.50 | | | 231,399.50 | | |
| Belle Fourche, South Dakota | 4,230,059.65 | | 4,230,059.65 | 2,679,945.95 | | | 2,679,945.95 | 1,550,113.70 | |
| Bitter Root, Montana | 1,052,741.05 | \$225,000.00 | 1,277,741.05 | 669,815.62 | | \$225,000.00 | 894,815.62 | 382,925.43 | |
| Boise, Idaho-Oregon | 28,268,576.86 | 2,225,000.00 | 30,493,576.86 | 14,642,423.32 | 1,033,381.40 | 2,225,000.00 | 17,900,804.72 | 12,592,772.14 | \$3,102.35 |
| Boulder Canyon, Arizona-California: | | | | | | | | | |
| All-American Canal System | 52,444,205.61 | | 52,444,205.61 | 51,470,600.45 | | | 51,470,600.45 | 973,605.16 | |
| Buffalo Rapids, Montana | 1,626,000.00 | | 1,626,000.00 | 1,559,700.00 | | | 1,559,700.00 | 66,300.00 | 10,950.00 |
| Burnt River, Oregon | 599,735.00 | | 599,735.00 | 329,842.40 | | | 329,842.40 | 269,892.60 | |
| Cachuma, California | 5,800,000.00 | | 5,800,000.00 | 5,797,443.00 | | | 5,797,443.00 | 2,557.00 | |
| Carlsbad, New Mexico | 3,741,760.67 | 25,000.00 | 3,766,760.67 | 1,825,993.72 | 64,070.00 | 23,500.00 | 1,913,563.72 | 1,853,196.95 | |
| Central Valley, California | 62,483,022.35 | | 62,483,022.35 | 62,342,519.95 | | | 62,342,519.95 | 140,502.40 | |
| Chief Joseph Dam, Foster Creek Division, Washington | 1,373,200.00 | | 1,373,200.00 | 1,373,200.00 | | | 1,373,200.00 | | |
| Colorado-Big Thompson, Colorado | 26,032,704.85 | | 26,032,704.85 | 26,032,576.99 | | | 26,032,576.99 | 127.86 | |
| Colorado River, Texas | 5,510,500.00 | | 5,510,500.00 | 5,510,500.00 | | | 5,510,500.00 | | |
| Columbia Basin, Washington | 87,547,720.80 | | 87,547,720.80 | 87,479,490.52 | | | 87,479,490.52 | 68,230.28 | 229.53 |
| Crescent Lake Dam, Oregon | | 320,000.00 | 320,000.00 | | | 320,000.00 | | | |
| Dalton Gardens, Idaho | 270,200.00 | | 270,200.00 | 270,200.00 | | | 270,200.00 | | |
| Deschutes, Oregon | 12,757,159.80 | | 12,757,159.80 | 12,460,630.30 | | | 12,460,630.30 | 296,529.50 | |
| Eden, Wyoming | 1,500,000.00 | | 1,500,000.00 | 1,500,000.00 | | | 1,500,000.00 | | |
| Fort Sumner, New Mexico | 2,432,166.55 | | 2,432,166.55 | 2,310,558.23 | | | 2,310,558.23 | 121,608.32 | |
| Fruitgrowers Dam, Montana | 297,282.04 | | 297,282.04 | 229,056.63 | | | 229,056.63 | 68,225.41 | |
| Fruitgrowers Dam, Colorado | 198,240.71 | | 198,240.71 | 137,397.79 | | | 137,397.79 | 60,842.92 | |
| Gila, Arizona | 48,116,167.45 | | 48,116,167.45 | 48,092,417.47 | | | 48,092,417.47 | 23,749.98 | |
| Grand Valley, Colorado | 2,124,314.37 | | 3,962,642.10 | 1,249,721.38 | | 1,806,827.73 | 3,056,549.11 | 906,092.99 | |
| Humboldt, Nevada | 1,211,244.68 | 123,000.00 | 1,334,244.68 | 711,956.26 | 26,902.68 | 123,000.00 | 861,858.94 | 472,385.74 | |
| Huntley, Montana | 1,839,673.68 | 100,000.00 | 1,939,673.68 | 680,900.87 | 91,104.91 | 100,000.00 | 872,005.78 | 1,067,667.90 | |
| Hyrum, Utah | 944,046.36 | | 944,046.36 | 652,112.00 | | | 652,112.00 | 291,934.36 | |
| Intake, Montana | 46,900.00 | | 46,900.00 | 42,194.00 | | | 42,194.00 | 4,706.00 | |
| Kendrick, Wyoming | 2,800,000.00 | | 2,800,000.00 | 2,800,000.00 | | | 2,800,000.00 | | |
| Klamath, Oregon-California | 7,759,344.20 | 40,200.26 | 7,799,544.46 | 4,451,230.02 | 164,651.86 | 30,150.00 | 4,646,031.88 | 3,153,512.58 | 25,302.30 |
| Lewisville Orchards, Idaho | 2,500,000.00 | | 2,500,000.00 | 2,415,071.44 | | | 2,415,071.44 | 84,928.56 | |
| Lower Yellowstone, Montana-North Dakota | 4,087,893.81 | | 4,087,893.81 | 1,288,319.13 | 279,703.78 | | 1,568,022.91 | 2,519,870.90 | 45,800.52 |

| | | | | | | | |
|--|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Maneros, Colorado..... | 900,000.00 | 900,000.00 | 855,000.00 | 855,000.00 | 45,000.00 | 855,000.00 | 45,000.00 |
| Michaud Flats, Idaho..... | 2,875,000.00 | 2,875,000.00 | 2,875,000.00 | 2,875,000.00 | 15,740,000.00 | 15,740,000.00 | 16,949.22 |
| Middle Rio Grande, New Mexico..... | 15,740,000.00 | 13,740,000.00 | 13,740,000.00 | 13,740,000.00 | 6,376,440.13 | 6,376,440.13 | 1,044.73 |
| Milk River, Montana..... | 7,777,644.89 | 7,912,495.89 | 6,376,440.13 | 6,376,440.13 | 4,747,878.92 | 4,747,878.92 | 11,390.00 |
| Minidoka, Idaho-Wyoming..... | 21,795,896.47 | 21,795,896.47 | 841,917.53 | 799,137.53 | 44,156.00 | 44,156.00 | 84.98 |
| Minidoka Flats, Nebraska..... | 841,917.53 | 841,917.53 | 44,156.00 | 44,156.00 | 34,970,739.02 | 34,970,739.02 | 84.98 |
| Missoula Valley, Montana..... | 45,000.00 | 45,000.00 | 34,970,739.02 | 34,970,739.02 | 1,034,974.04 | 1,034,974.04 | 2,791,863.91 |
| Missouri River Basin..... | 34,970,824.00 | 34,970,824.00 | 1,592,267.76 | 1,592,267.76 | 271,250.00 | 271,250.00 | 78,750.00 |
| Moore Lake, Utah..... | 1,592,267.76 | 1,592,267.76 | 3,257,749.35 | 3,257,749.35 | 3,801,396.90 | 3,801,396.90 | 16,470,247.41 |
| Moon Lake, Nevada..... | 3,257,749.35 | 3,257,749.35 | 350,000.00 | 350,000.00 | 4,734,335.11 | 4,734,335.11 | 1,344,814.29 |
| Newlands, Nevada..... | 350,000.00 | 350,000.00 | 24,015,786.25 | 24,015,786.25 | 3,801,396.90 | 3,801,396.90 | 250,318.11 |
| North Platte, Nebraska-Wyoming..... | 20,236,195.85 | 20,236,195.85 | 4,734,335.11 | 4,734,335.11 | 218,279.74 | 218,279.74 | 1,610,362.27 |
| Ogden River, Utah..... | 4,734,335.11 | 4,734,335.11 | 594,597.85 | 594,597.85 | 694,224.55 | 694,224.55 | 2,517,254.85 |
| Okanogan, Washington..... | 468,597.85 | 468,597.85 | 2,999,625.38 | 2,999,625.38 | 17,309,404.62 | 17,309,404.62 | 10,000.00 |
| Orland, California..... | 2,457,212.15 | 2,457,212.15 | 19,826,659.47 | 19,826,659.47 | 7,301,675.00 | 7,301,675.00 | 329,180.00 |
| Owyhee, Oregon-Idaho..... | 19,826,659.47 | 19,826,659.47 | 7,301,675.00 | 7,301,675.00 | 1,665,000.00 | 1,665,000.00 | 3,419,304.80 |
| Palisades, Idaho..... | 7,301,675.00 | 7,301,675.00 | 1,675,000.00 | 1,675,000.00 | 2,320,000.00 | 2,320,000.00 | 125,000.00 |
| Palo Verde, California..... | 1,675,000.00 | 1,675,000.00 | 2,320,000.00 | 2,320,000.00 | 28,717,581.85 | 28,717,581.85 | 7,243,010.68 |
| Paonia, Colorado..... | 2,320,000.00 | 2,320,000.00 | 1,500,000.00 | 1,500,000.00 | 975,000.00 | 975,000.00 | 665,449.74 |
| Pine River, Colorado..... | 1,500,000.00 | 1,500,000.00 | 32,136,886.65 | 32,136,886.65 | 790,003.27 | 790,003.27 | 85,000.00 |
| Provo River, Utah..... | 1,100,000.00 | 1,100,000.00 | 1,100,000.00 | 1,100,000.00 | 2,333,150.53 | 2,333,150.53 | 2,729,008.46 |
| Rapid Valley, South Dakota..... | 855,909.19 | 855,909.19 | 10,144,123.26 | 10,144,123.26 | 6,716,377.32 | 6,716,377.32 | 1,762,524.01 |
| Rathdrum Prairie, Idaho..... | 10,144,123.26 | 10,144,123.26 | 9,881,827.26 | 9,881,827.26 | 5,810,000.00 | 5,810,000.00 | 350,339.58 |
| Rio Grande, New Mexico-Texas..... | 7,381,827.26 | 7,381,827.26 | 5,810,000.00 | 5,810,000.00 | 4,516,320.35 | 4,516,320.35 | 45,855.84 |
| Riverton, Wyoming..... | 5,810,000.00 | 5,810,000.00 | 24,239,991.60 | 24,239,991.60 | 2,520,000.00 | 2,520,000.00 | 1,206,838.29 |
| Rogue River-Talent Division, Oregon..... | 17,482,687.89 | 17,482,687.89 | 2,520,000.00 | 2,520,000.00 | 214,481.11 | 214,481.11 | 546,640.64 |
| Salt River, Arizona..... | 2,520,000.00 | 2,520,000.00 | 373,375.94 | 373,375.94 | 13,969,000.00 | 13,969,000.00 | 1,892,135.69 |
| San Luis Valley, Colorado..... | 373,375.94 | 373,375.94 | 13,969,000.00 | 13,969,000.00 | 162,000.00 | 162,000.00 | 13,903,719.62 |
| Sanpete, Utah..... | 13,969,000.00 | 13,969,000.00 | 247,000.00 | 247,000.00 | 4,478,601.06 | 4,478,601.06 | 5,184,035.90 |
| Santa Maria, California..... | 247,000.00 | 247,000.00 | 7,207,609.52 | 7,207,609.52 | 8,239,211.96 | 8,239,211.96 | 567,694.51 |
| Seaford, Utah..... | 7,207,609.52 | 7,207,609.52 | 3,349,423.92 | 3,349,423.92 | 36,351.04 | 36,351.04 | 129,280,918.50 |
| Shoshone, Wyoming-Montana..... | 3,349,423.92 | 3,349,423.92 | 10,001,735.97 | 10,001,735.97 | 2,500,000.00 | 2,500,000.00 | |
| Strawberry Valley, Utah..... | 9,963,584.93 | 9,963,584.93 | 1,000,000.00 | 1,000,000.00 | 5,742,561.39 | 5,742,561.39 | |
| Sun River, Montana..... | 1,000,000.00 | 1,000,000.00 | 5,501,896.86 | 5,501,896.86 | 5,896,041.02 | 5,896,041.02 | |
| Truckee Storage, Nevada..... | 5,001,896.86 | 5,001,896.86 | 1,044,212.22 | 1,044,212.22 | 5,607,179.07 | 5,607,179.07 | |
| Tuacumcari, New Mexico..... | 1,044,212.22 | 1,044,212.22 | 6,874,017.36 | 6,874,017.36 | 4,475,646.86 | 4,475,646.86 | |
| Unamilla, Oregon..... | 6,874,017.36 | 6,874,017.36 | 5,022,287.50 | 5,022,287.50 | 27,500,000.00 | 27,500,000.00 | |
| Uncompahgre, Colorado..... | 5,022,287.50 | 5,022,287.50 | 27,500,000.00 | 27,500,000.00 | 2,107,943.33 | 2,107,943.33 | |
| Vale, Oregon..... | 27,500,000.00 | 27,500,000.00 | 2,107,943.33 | 2,107,943.33 | 57,694,000.00 | 57,694,000.00 | |
| Ventura River, California..... | 2,107,943.33 | 2,107,943.33 | 57,694,000.00 | 57,694,000.00 | 505,929.30 | 505,929.30 | |
| Vermayo, New Mexico..... | 57,694,000.00 | 57,694,000.00 | 2,685,871.83 | 2,685,871.83 | 42,084.99 | 42,084.99 | |
| Weber Basin, Utah..... | 2,685,871.83 | 2,685,871.83 | 47,210,396.06 | 47,210,396.06 | 181,840.83 | 181,840.83 | |
| Yakima, Washington..... | 46,497,653.59 | 46,497,653.59 | 5,365,876.73 | 5,365,876.73 | 992,573.88 | 992,573.88 | |
| Yuma, Arizona-California..... | 5,365,876.73 | 5,365,876.73 | 1,560,268.39 | 1,560,268.39 | 18,370,722.62 | 18,370,722.62 | |
| Yuma Auxiliary, California..... | 1,560,268.39 | 1,560,268.39 | 819,538,198.77 | 819,538,198.77 | 2,795,646.69 | 2,795,646.69 | |
| Subtotal, U. S. total..... | 799,604,098.93 | 799,604,098.93 | 19,874,099.84 | 19,874,099.84 | 609,090,910.96 | 609,090,910.96 | |

See footnote at end of table

TABLE 4.—*Repayment contracts—matured and unmatured, June 30, 1957* Continued

| Project and State | Value of repayment contracts | | | Unmatured value of repayment contracts | | | | Matured value of repayment contracts | Amount due and unpaid ¹ |
|---------------------------------|------------------------------|-------------------------------|----------------|--|------------------|-------------------------------|----------------|--------------------------------------|------------------------------------|
| | Construction | Rehabilitation and betterment | Total | Construction | Deferred charges | Rehabilitation and betterment | Total | | |
| PROPERTY TITLED IN WATER USERS | | | | | | | | | |
| Arnold, Oregon | | \$197,925.82 | \$197,925.82 | | | \$165,039.81 | \$165,039.81 | \$32,886.01 | |
| Grand Valley, Colorado | \$1,004,839.84 | | 1,004,839.84 | \$390,790.96 | | | 390,790.96 | 614,048.88 | |
| Grants Pass, (S. R. D.), Oregon | | 950,000.00 | 950,000.00 | | | 937,500.00 | 937,500.00 | 12,500.00 | |
| Ochoco, Oregon | | 500,000.00 | 500,000.00 | | | 500,000.00 | 500,000.00 | | |
| Preston Bench, Idaho | 450,300.33 | | 450,300.33 | 450,300.33 | | | 450,300.33 | | |
| Rogue River, Oregon | | 1,712,000.00 | 1,712,000.00 | | | 1,712,000.00 | 1,712,000.00 | | |
| Umatilla, Oregon | 97,830.24 | | 97,830.24 | 52,677.78 | | | 52,677.78 | 45,152.46 | |
| Subtotal, Water Users' Title | 1,552,970.41 | 3,350,925.82 | 4,912,896.23 | 893,769.07 | | 3,314,539.81 | 4,208,308.88 | 704,587.35 | |
| Total repayment contracts | 801,217,069.34 | 23,234,025.66 | 824,451,095.00 | 669,984,680.03 | \$2,795,646.69 | 21,685,262.43 | 694,465,589.15 | 129,985,505.85 | \$158,757.80 |

¹ \$129,964.48 paid by October 31, 1957.

Each of the 17 Western States participated in the Reclamation harvest for 1956. Idaho had a larger acreage of irrigated Federal project lands than any of the other States, followed by California, Colorado, Washington, Oregon, Arizona, Nebraska, Utah, and Montana. The gross value of crops produced on Federal projects located in California was higher than for the other Western States; however, the average gross crop value per acre was highest for Arizona, followed by Texas, California, Washington, New Mexico, Oklahoma, etc.

Repayment and Water Service Contracts

During fiscal year 1957, contracts were executed with a number of districts for the repayment of the cost of new project works. The distribution system loan repayment contract with the Solano Irrigation District, Solano project, California, was the first loan repayment contract to be executed under the new loan program authorized by Public Law 130 of the 84th Congress (69 Stat. 244). After this contract has been validated in the courts of California, the United States will advance funds on an approved schedule basis to the Solano Irrigation District over a period of years to permit the District to finance construction of distribution system works.

The Solano Irrigation District is one of several member units that have contracted with the Solano County Flood Control and Water Conservation District for water service from the Solano project. All of these member unit contracts have been validated in the courts of California. Negotiations were well advanced with several districts of the Central Valley project for similar distribution system loans.

Amendment in June of 1957 of the Small Reclamation Project Act, as requested by the President, and approval by the Secretary of the Interior on July 5, 1957, of a small project loan request by the Cameron County Water Improvement District No. 1, located in the lower Rio Grande Valley of Texas, cleared the way for initiation of repayment contract negotiations for the first small project loan.

Repayment contracts involving new construction work were executed with the Bridgeport Irrigation District, Chief Joseph Dam project, Idaho; Juniper Flats District Improvement Co., Wapinitia project, Oregon; Collbran Conservancy District, Collbran project, Colorado; and with the following organizations of the Missouri River Basin project: Owl Creek Irrigation District and Helena Valley Irrigation District in Montana, Loup Basin Reclamation District in Nebraska, Ainsworth Irrigation District in Nebraska, Frenchman

Valley Irrigation District in Nebraska, H. and R. W. Irrigation District in Nebraska, and the Webster Irrigation District in Kansas.

* * * * *

During the fiscal year, negotiations were carried to completion for execution of a repayment contract (actually executed shortly after close of fiscal year, on July 23, 1957) with the Fort Cobb Master Conservancy District, Fort Cobb Division, Washita project, Oklahoma. The contractual arrangements are unique in that first stage construction involves municipal water, with irrigation scheduled for second stage construction. In the event irrigation does not develop within 10 years of the time when municipal water becomes available, then the authorization of the irrigation features expires. If irrigation fails to develop, municipal water payments will continue until all of the reimbursable costs of the project, including those allocated to irrigation, are fully repaid. Municipal water costs are to be repaid with interest on the unamortized balance at a rate certified by the Secretary of the Treasury of 2.591 percent.

Considerable progress was made in the negotiation of water service contracts for the Sacramento Canals Unit of the Central Valley project, California. The first contract to be executed for this service area was with the Corning Water District. At the close of the fiscal year negotiations had been completed with the Westside Water District, Dunnigan Water District, Colusa County Water District, Kanawha Water District, and the Proberta Water District.

Contract negotiations in California, however, have been affected by the action of the California Supreme Court in the *Ivanhoe* case, wherein the court held water users organizations in California were not empowered to execute contracts containing excess land provisions. Pending a review of the matter by the United States Supreme Court, which has been requested, the Government is continuing to make water deliveries in compliance with existing contract requirements.

The contract executed with the Yuma County Water Users Association, Valley Division, Yuma project, Arizona, as authorized by the act of June 29, 1956 (70 Stat. 409), provided for final repayment of the remaining reimbursable costs of the Valley Division. A number of contracts also were executed involving rehabilitation and betterment of project works and providing for temporary or interim water supplies.

Table 4 shows that the total value of repayment contracts on June 30, 1957, amounted to \$824,451,095. Of this amount, a total of \$129,826,748 had been repaid, and delinquencies were insignificant. In addition, over \$100 million will be returned to the Government in water service payments under contracts now in force.

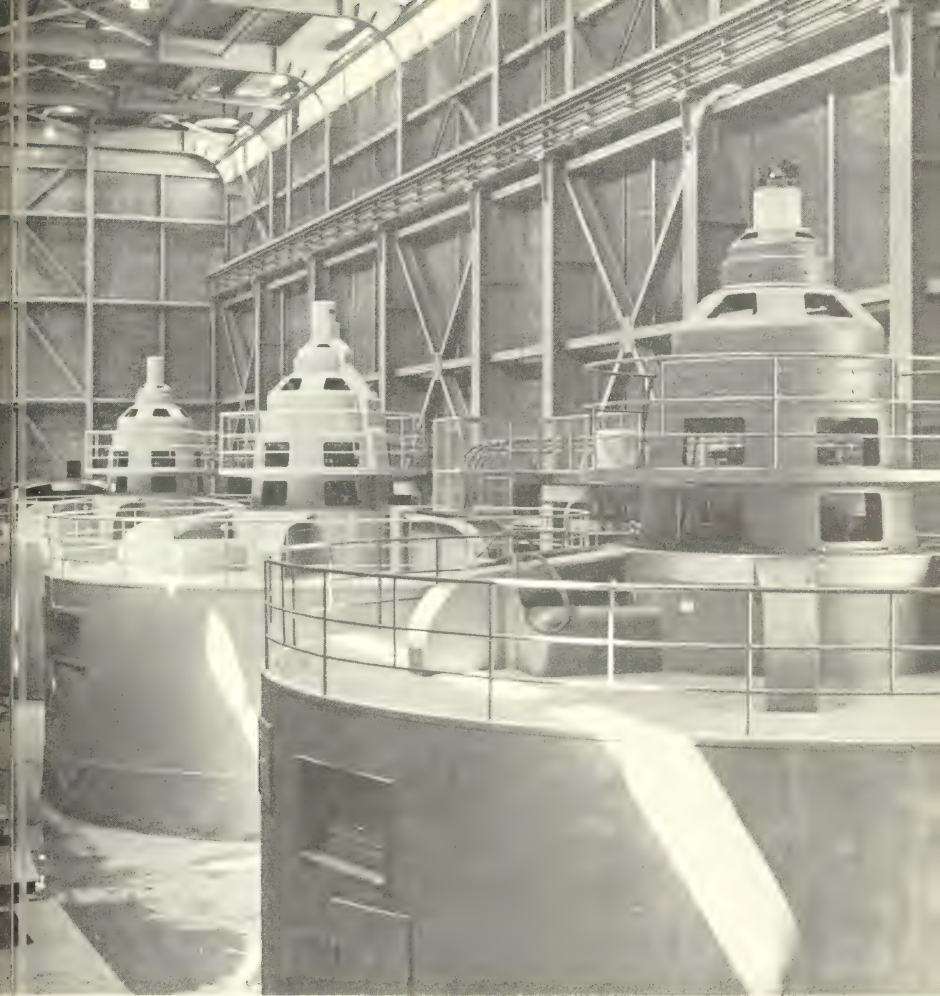


FIGURE 4.—More power for Northwest. These four generators installed in the powerplant at the Palisades Dam on the Snake River in Idaho to furnish 114,000 additional kilowatts of hydroelectric power for the Pacific Northwest, are typical of operations under the Federal Reclamation program which last year provided more than 25.6 billion kilowatt-hours of electric power. The 36 powerplants constructed in the West by the Bureau of Reclamation have a total installed capacity of 5,031,550 kilowatts.

Land Openings

The Bureau conducted five land openings on three Reclamation projects, making available for settlement 290 farm units embracing 33,482 irrigable acres of new land. The greatest number were on the North Side pumping unit of the Minidoka project in Idaho where 145 units were opened for settlement under the provisions of reclamation and homestead laws. Six farm units were offered for homestead

entry on the Hanover-Bluff unit, Bighorn Basin Division, Missouri River Basin project. The remaining 139 units were offered for sale through three separate openings on the Columbia Basin project in Washington, under the provisions of the Columbia Basin Project Act.

Since the close of World War II, 57 land openings have been held on 14 Reclamation projects. A total of 2,684 new farm units encompassing approximately 235,000 irrigable acres of public land have thus been made available for selection by qualified applicants.

The availability of additional new farm units is anticipated during fiscal year 1958 on the Columbia Basin project in Washington, the Minidoka project in Idaho, and on the Gila and Yuma projects in Arizona. Additional privately owned lands in the Central Valley, Columbia Basin, and Missouri Basin projects will be supplied with irrigation water. A considerable amount of this privately owned land may be available for sale by the owners.

Development Farms

A vital part of the settlement program on areas being newly developed for irrigation is the development farm program, started in 1947. These farms are conducted in cooperation with various agricultural agencies and State agricultural colleges.

Field scale operations are conducted to demonstrate to the inexperienced irrigation farmers the layout of most practical farm irrigation systems, the best methods of irrigation, the crops best adapted to the area, and the most effective cultural practices.

The research conducted by the cooperating agricultural agencies, on the 10 to 20 percent of each farm set aside for this purpose, furnishes valuable information to the new settlers. Field days, tours, and other educational media are used to disseminate the information obtained from the research and to explain the demonstrations to the farmers.

The farm sites are chosen in cooperation with other interested agencies in areas best representing the soils and other conditions common to the project. They are established 2 to 5 years in advance of settlement in order to have the desired information by the time the new settlers arrive.

During fiscal year 1957 there were 15 development farms in operation on the Columbia Basin, Gila, and Missouri River Basin projects, with several new farms proposed for the latter project.

Soil and Moisture Conservation Operations

The Bureau of Reclamation continued to make progress in protecting the land and facilities under its jurisdiction.

Protection of land from wind and water erosion, reduction of moisture losses from land and water areas, and the protection of Reclamation-built structures from the adverse effects of soil erosion was continued by the Bureau during the year. The work included structural installations, reseeding, and other means of erosion control and stabilization.

The planning, financing, and performance of the work are accomplished in cooperation with other Federal agencies and State and local agencies, including water users' organizations.

Weed Control

The weed control program conducted by the Bureau on irrigation systems has reduced the problems caused by undesirable vegetation and also cut operation and maintenance costs. It also aided materially in reducing water losses resulting from transpiration, evaporation, and seepage due to weed growths.

More efficient and economical methods of controlling weeds infesting banks and channels of irrigation systems were developed and put into practice through the research program conducted by the Agricultural Research Service, Department of Agriculture, in cooperation with the Bureau of Reclamation. This work has been accomplished at field stations at Phoenix, Ariz.; Prosser, Wash.; Bozeman, Mont.; and Laramie, Wyo., and in the Reclamation weed control laboratory in Denver.

Under the provisions of the Halogeton Glomeratus Act (Public Law 529, July 14, 1952), the Bureau is cooperating in the control of the poisonous weed halogeton on Bureau lands in Utah, Nevada, Colorado, Wyoming, Montana, and Idaho.

Cooperation With Other Agencies

Certain of the Bureau's activities in planning, developing, and operating its irrigation projects are accomplished or facilitated through cooperation with other agencies, when the employment of their special skills, experience, and equipment will be beneficial to the Government.

These cooperative undertakings are carried out by means of agreements between the Bureau and the other agencies involved which include, principally, units of the Department of Agriculture and the State colleges and extension services, but often involve other Federal, State, and local agencies.

During fiscal year 1957 there were nearly 200 such cooperative agreements in effect. They pertain to studies and investigations conducted on development farms, conservation and efficient use of soil and water, crop and cropping problems, assistance to county agricultural agents, and weed control studies. They cover also the development and management of reservoir recreational areas, financial aid to new settlers, and assistance in solving many other problems pertaining to the development of irrigation projects.

TABLE 5.—*Hydroelectric powerplants*

| State or Territory | Project | Name of plant | Calendar year of initial operation | Nameplate rating | |
|---|-----------------------------|---------------------------|------------------------------------|-----------------------|-----------------------|
| | | | | Existing (kilo-watts) | Ultimate (kilo-watts) |
| A. Constructed and operated by Bureau of Reclamation | | | | | |
| 1. Alaska | Eklutna | Eklutna | 1955 | 30,000 | 30,000 |
| 2. Alaska | do | Old Eklutna ¹ | 1955 | 2,000 | 2,000 |
| 3. Arizona-Nevada | Boulder Canyon | Hoover ² | 1936 | 1,249,800 | 1,354,300 |
| 4. Arizona-Nevada | Parker-Davis | Davis | 1951 | 225,000 | 225,000 |
| 5. Arizona-Nevada | do | Parker | 1942 | 120,000 | 120,000 |
| 6. California | Central Valley | Folsom | 1955 | 162,000 | 162,000 |
| 7. California | do | Keswick | 1949 | 75,000 | 75,000 |
| 8. California | do | Nimbus | 1955 | 13,500 | 13,500 |
| 9. California | do | Shasta | 1944 | 379,000 | 379,000 |
| 10. California | Yuma | Siphon Drop | 1926 | 1,600 | 1,600 |
| 11. Colorado | Colorado-Big Thompson | Estes | 1950 | 45,000 | 45,000 |
| 12. Colorado | do | Flatiron | 1954 | 71,500 | 71,500 |
| 13. Colorado | do | Green Mountain | 1943 | 21,600 | 21,600 |
| 14. Colorado | do | Marys Lake | 1951 | 8,100 | 8,100 |
| 15. Colorado | do | Polehill | 1954 | 33,250 | 33,250 |
| 16. Colorado | Grand Valley | Grand Valley ³ | 1932 | 3,000 | 3,000 |
| 17. Idaho | Boise | Anderson Ranch | 1950 | 27,000 | 40,500 |
| 18. Idaho | do | Black Canyon | 1925 | 8,000 | 8,000 |
| 19. Idaho | do | Boise Diversion | 1912 | 1,500 | 1,500 |
| 20. Idaho | Minidoka | Minidoka | 1909 | 13,400 | 13,400 |
| 21. Idaho | Palisades | Palisades | 1957 | 57,000 | 114,000 |
| 22. Montana | Missouri River Basin | Canyon Ferry | 1953 | 50,000 | 50,000 |
| 23. Montana | Hungry Horse | Hungry Horse | 1952 | 285,000 | 285,000 |
| 24. New Mexico | Rio Grande | Elephant Butte | 1940 | 24,300 | 24,300 |
| 25. South Dakota | Missouri River Basin | Angostura | 1951 | 1,200 | 1,200 |
| 26. Washington | Columbia Basin | Grand Coulee | 1941 | 1,974,000 | 1,974,000 |
| 27. Washington | Yakima-Kennewick | Chandler | 1956 | 12,000 | 12,000 |
| 28. Wyoming | Kendrick | Alcova | 1955 | 36,000 | 36,000 |
| 29. Wyoming | do | Seminole | 1939 | 32,400 | 32,400 |
| 30. Wyoming | Missouri River Basin | Boysen | 1952 | 15,000 | 15,000 |
| 31. Wyoming | do | Kortes | 1950 | 36,000 | 36,000 |
| 32. Wyoming | North Platte | Guernsey | 1927 | 4,800 | 4,800 |
| 33. Wyoming | do | Lingle ⁴ | 1919 | 1,400 | 1,400 |
| 34. Wyoming | Riverton | Pilot Butte | 1925 | 1,600 | 1,600 |
| 35. Wyoming | Shoshone | Heart Mountain | 1948 | 5,000 | 5,000 |
| 36. Wyoming | do | Shoshone | 1922 | 5,600 | 5,600 |
| Subtotal A | | | | 5,031,550 | 5,206,550 |
| B. Constructed and operated by others—power marketed by United States Bureau of Reclamation | | | | | |
| 1. Montana | Fort Peck (USCE) | Fort Peck | 1943 | 85,000 | 165,000 |
| 2. North Dakota | Missouri River Basin (USCE) | Garrison | 1956 | 240,000 | 400,000 |
| 3. South Dakota | do | Fort Randall | 1954 | 320,000 | 320,000 |
| 4. South Dakota | do | Gavins Point | 1956 | 100,000 | 100,000 |
| 5. Texas | Falcon (IBWC) | Falcon | 1954 | 31,500 | 42,000 |
| Subtotal B | | | | 776,500 | 1,027,000 |

TABLE 5.—*Hydroelectric powerplants—Continued*

| State or Territory | Project | Name of plant | Calen- dar year of initial opera- tion | Nameplate rating | |
|---|----------------------------------|---------------------|---|------------------------------|------------------------------|
| | | | | Existing (kilo- watts) | Ultimate (kilo- watts) |
| C. Under construction by Bureau of Reclamation | | | | | |
| 1. Arizona..... | Colorado River Storage..... | Glen Canyon..... | 1963..... | ..... | 900,000 |
| 2. Colorado..... | Colorado-Big Thompson..... | Big Thompson..... | 1959..... | ..... | 4,500 |
| 3. Oregon..... | Rogue River..... | Green Springs..... | 1959..... | ..... | 16,000 |
| 4. Utah..... | Colorado River Storage..... | Flaming Gorge..... | 1963..... | ..... | 105,000 |
| 5. Utah..... | Provo River Basin..... | Deer Creek..... | 1957..... | ..... | 5,000 |
| 6. Utah..... | Weber Basin..... | Gateway..... | 1958..... | ..... | 4,000 |
| 7. Utah..... | do..... | Wanship..... | 1958..... | ..... | 1,400 |
| 8. Washington..... | Yakima-Roza..... | Roza..... | 1958..... | ..... | 11,250 |
| 9. Wyoming..... | Missouri River Basin..... | Glendo..... | 1958..... | ..... | 24,000 |
| 10. Wyoming..... | do..... | Fremont Canyon..... | 1960..... | ..... | 48,000 |
| Subtotal C..... |  |  |  | ..... | 1,119,150 |
| D. Under construction by others—power to be marketed by United States Bureau of Reclamation | | | | | |
| 1. South Dakota..... | Missouri River Basin (USCE)..... | Oahe..... | 1962..... | ..... | 595,000 |
| Subtotal D..... |  |  |  | ..... | 595,000 |
| Total..... | | | | 5,808,050 | 7,947,700 |

NOTES:

¹ Acquired from city of Anchorage for operation with Eklutna Project fiscal year 1955.² Powerplant units operated by Southern California Edison Co. and city of Los Angeles Department of Water and Power as agents of the United States.³ Leased to Public Service Co. of Colorado for operation.⁴ On nonoperating status from May 1, 1956.

U. S. C. E.—United States Corps of Engineers.

I. B. W. C.—International Boundary and Water Commission.

HYDROELECTRIC POWER DEVELOPMENT

Present Installed Capacity

In order to utilize to the greatest extent, the water storage at multipurpose reservoirs, the Bureau of Reclamation has constructed 36 powerplants with an installed nameplate capacity of 5,031,550 kilowatts. In addition, the Bureau is responsible for marketing the power generated at five powerplants constructed by the Corps of Engineers and the International Boundary and Water Commission, with a total nameplate capacity of 776,500 kilowatts.

Sale of electric power by the Bureau during the year aggregated 25,654,251,471 kilowatt-hours, with revenues from sales totaling \$60,153,473.83, as shown on table 6.

Fiscal Year Expansion

During the fiscal year ending June 30, 1957, the installed nameplate capacity of hydroelectric powerplants at Bureau of Reclamation multipurpose projects and at projects for which the Bureau is re-

sponsible for marketing the power, increased 237,000 kilowatts over 1956. The projects were:

| | Kilowatts capacity |
|--|-----------------------|
| Bureau of Reclamation: | |
| Palisades project (units 2 and 3) | 57,000 |
| U. S. Corps of Engineers: | |
| Missouri River Basin project (Garrison unit 3) | 80,000 |
| Missouri River Basin project (Gavins Point) | 100,000 |

TABLE 6.—Bureau of Reclamation power systems, power sales, and revenues by projects, fiscal year ending June 30, 1957

| Projects | Sales of electric energy, kilo- watt-hours ¹ | Revenues from sales ¹ |
|-------------------------------------|---|-------------------------------------|
| Boise | 179,132,956 | \$234,815.82 |
| Boulder Canyon | 2,641,458,899 | 7,598,401.25 |
| Central Valley | 2,788,301,742 | 11,159,579.40 |
| Columbia Basin ² | 13,645,815,000 | 12,629,813.02 |
| Eklutna | 130,912,370 | 1,390,448.56 |
| Falcon Dam | 23,181,400 | 46,928.82 |
| Fort Peck | 259,944,183 | 1,120,762.03 |
| Hungry Horse ² | 896,719,100 | 3,563,114.30 |
| Mimidoka | 149,663,479 | 668,426.18 |
| Missouri River Basin: | | |
| Eastern Division | 2,411,796,063 | 8,838,312.13 |
| Western Division ³ | 1,162,680,702 | 7,209,993.26 |
| North Platte | 94,778,065 | 616,001.07 |
| Palisades | 98,695,273 | 329,680.80 |
| Parker-Davis | 1,056,587,345 | 4,233,223.11 |
| Rio Grande | 40,989,524 | 268,517.40 |
| Yakima ² | 65,103,996 | 220,166.54 |
| Yuma | 8,491,374 | 25,049.64 |
| Grand total | 25,654,251,471 | 60,153,433.33 |

¹ Does not include energy sales and revenues in transactions between Bureau projects.

² Deliveries to and revenues from Bonneville Power Administration included as follows:

| | Kilowatt-hours | |
|----------------------|----------------|-----------------|
| Columbia Basin | 13,081,048,951 | \$12,347,430.00 |
| Hungry Horse | 894,358,000 | 3,553,000.00 |
| Yakima | 65,072,099 | 220,000.00 |

Total

³ Includes systems of Riverton, Shoshone, Colorado-Big Thompson, and Kendrick projects.

Additional Capacity Under Construction

At the end of fiscal year 1957, the Bureau of Reclamation had under construction 10 powerplants, which will have an ultimate installed nameplate capacity of 1,119,150 kilowatts. They are listed below:

| State | Plant | Project | River | Nameplate capacity (kw.) |
|------------------|----------------------|------------------------------|-------------------------|--------------------------------|
| Arizona | Glen Canyon | Colorado River Storage | Colorado | 900,000 |
| Colorado | Big Thompson | Colorado-Big Thompson | Big Thompson | 4,500 |
| Oregon | Green Springs | Rogue River Basin | Emigrant Creek | 16,000 |
| Utah | Flaming Gorge | Colorado River Storage | Green | 105,000 |
| Do | Deer Creek | Provo River Basin | Provo | 5,000 |
| Do | Gateway | Weber | Weber | 4,000 |
| Do | Wanship | do | do | 1,400 |
| Washington | Roza | Yakima-Roza | Yakima-Roza Canal | 11,250 |
| Wyoming | Glendo | Missouri River Basin | North Platte | 24,000 |
| Do | Fremont Canyon | do | do | 48,000 |

The United States Army Corps of Engineers is proceeding with the construction of its plants in the Missouri River Basin project. The ultimate nameplate capacity of Oahe Powerplant in South Dakota will be 595,000 kilowatts. The Bureau of Reclamation will be the marketing agent for energy generated from this plant as is the case for other plants constructed by the Corps on the Missouri River Basin project.

Hydroelectric Powerplants

The hydroelectric powerplants constructed and operated, under construction and authorized to be constructed by the Bureau of Reclamation and powerplants for which the Bureau is the marketing agent are listed in table 5.

Transmission System

To furnish the electrical energy for the Bureau's projects and to market the power which is surplus to the Bureau's needs, a transmission system including powerplant substations, switchyards, and transmission lines, has been constructed. During the fiscal year ending June 30, 1957, nearly 460 circuit miles of transmission lines were completed to increase the total system to 9,855 circuit miles of line. As of June 30, 1957, the installed transformer capacity of the individual substations operated by the Bureau was approximately 10,000 kilovolt-amperes.

The transmission lines completed in fiscal year 1957 are shown in table 7.

TABLE 7.—*Transmission lines completed during fiscal year 1957*

| Project and line | Voltage (kilovolts) | In service date | Circuit miles |
|--|------------------------|--------------------------------|------------------|
| Central Valley project: Folsom powerplant to Folsom Prison. | 4.16 | October 1955..... | 1.0 |
| Fort Peck project: Fort Peck powerplant to Whately Substation. | 69 | August 1956 ^a | (0.8) |
| Missouri River Basin project: | | | |
| Fargo to Grand Forks..... | 115 | June 1957..... | 83.0 |
| Edgeley to Groton..... | 115 | December 1956..... | 80.5 |
| Watertown to Granite Falls..... | 230 | (^b)..... | 74.1 |
| Granite Falls to Minnesota Valley..... | 230 | (^b)..... | 2.6 |
| Kendrick project: | | | |
| Alcova Powerplant to Gering..... | 115 | (^b)..... | 203.6 |
| Alcova Powerplant to Fremont..... | 115 | (^b)..... | 8.1 |
| Lingle Tap..... | 115 | (^b)..... | 5.7 |

^a Rebuilt line and placed in service on August 26, 1956.

^b Completed but not in service.

Power Contracts

During fiscal year 1957, there were 133 contracts executed for the delivery of electric power supply. Included among these are:

Number of contracts:

- 19 with private utilities.
- 54 with REA cooperatives.
- 38 with municipalities.
- 5 with other Federal agencies.
- 3 with public power districts.
- 9 with State authorities.
- 2 with irrigation district.
- 3 miscellaneous type contracts.

A number of contracts executed were renewals of operating contracts or revisions of existing contracts resulting from changed operating conditions.

The Bureau continued its policy of contracting whenever possible with private utilities, public bodies and cooperatives for wheeling power and energy over existing facilities. The Bureau also entered into several interchange agreements with its customers.

A summary by classification of customers served by Reclamation during fiscal year 1957 is shown in table 8.

The Bureau at the end of fiscal year 1957 had 98 contracts under active negotiation. In this number are included 28 contracts with municipalities, 34 with REA cooperatives, 17 with private utilities, 1 with public power district, 8 with other Federal agencies, 5 with State authorities, 3 with irrigation districts and 2 miscellaneous type contracts. A number of these are to renew the existing contracts, or to revise contracts in existence due to changes in operating conditions.

TABLE 8.—Summary by classification of customers for 12 months ending June 30, 1957¹

| Type of customers | Number of customers | Sales of electric energy | Revenues from sales |
|--|---------------------|--------------------------|---------------------|
| | | <i>Kilowatt-hours</i> | |
| Privately owned utilities..... | 32 | 3, 059, 251, 523 | \$11, 524, 270. 02 |
| Municipal utilities..... | 81 | 1, 067, 177, 719 | 5, 232, 645. 52 |
| State Government utilities..... | 15 | 3, 251, 240, 860 | 12, 085, 994. 10 |
| Cooperative utilities (Rural Electrification Administration projects)..... | 108 | 1, 541, 178, 411 | 8, 411, 752. 95 |
| Other Federal utilities ² | 7 | 14, 122, 771, 244 | 16, 482, 202. 51 |
| Residential and domestic..... | 277 | 5, 353, 930 | 30, 685. 63 |
| Rural (other than Rural Electrification Administration projects)..... | 8 | 147, 480 | 943. 40 |
| Commercial and industrial..... | 23 | 93, 039, 182 | 472, 867. 64 |
| Public authorities..... | 65 | 1, 575, 229, 149 | 4, 710, 925. 32 |
| Interdepartmental..... | 48 | 938, 861, 973 | 1, 201, 146. 24 |
| Total, all customers..... | 664 | 25, 654, 251, 471 | 60, 153, 433. 33 |

¹ Does not include energy sales and revenues in transactions between Bureau projects.

² Totals include 14,040,479,050 kilowatt-hours delivered to Bonneville Power Administration for marketing and \$16,120,430.00 in payments by that agency.

ENGINEERING AND CONSTRUCTION

In carrying out its construction activities for fiscal year 1957, the Bureau of Reclamation continued its program of developing water and land resources in the western United States and made important contributions to the expansion of the Nation's resource base. About \$130 million were converted into Reclamation works, an investment in dams, powerplants, irrigation canals, pumping plants, electric transmission lines, and other wealth-creating facilities available to serve the West and the Nation.

Construction completed during the year added more than 160,000 acre-feet of storage in new Reclamation project reservoirs, 57,000 kilowatts of hydroelectric generating capacity, 317 miles of canals, aqueducts, and related water conveyance and distribution structures, and 526 miles of large electrical transmission lines.

The total value of all contracts awarded in the fiscal year 1957 amounted to about \$299 million comprising the face value of more than 734 separate contracts for construction, materials, equipment, and supplies. Of this total amount, construction contracts accounted for about \$289 million or about 97 percent. The 193 construction contracts in force at the end of the year had a total value of about \$397 million.

The fiscal year will be remembered for the start of construction in April 1957 of the Glen Canyon Dam and powerplant, major features of the Colorado River Storage project.

The year was highlighted by several other notable construction events. On the Central Valley project in California, construction began on the Trinity Dam, a principal feature in the transbasin diversion of water from the Trinity River watershed to the adjacent Central Valley Basin. On the Solano project, also in California, Monticello Dam was essentially completed and storage began in Lake Berryessa, the new reservoir at the dam.

In Utah, Wanship Dam and 22 miles of the Davis and Weber aqueducts were completed on the Weber Basin project. The Palisades Dam and Powerplant on the Palisades project in Idaho were substantially completed and two of the powerplant's four generators were placed in operation. Missouri River Basin project construction was marked by completion of Pactola Dam in South Dakota and start of Anchor Dam in Wyoming.

Other fiscal year highlights included start of construction of the following important project features: Casitas Dam on the Ventura River Basin project, California; Fremont Canyon powerplant, in Wyoming, and Helena Valley pumping plant, in Montana, both on the Missouri River Basin project; Howard Prairie Dam on the Rogue

FIGURE 5.—Second highest dam in United States. Glen Canyon Dam, a wall of concrete shaped in an arch standing 700 feet above bedrock will fill this canyon on the Colorado River at the Arizona-Utah border when completed as a major structure in the Colorado River Storage project. Work on the project begun in 1957 will make possible the development of the vast Upper Colorado River Basin's irrigable lands and abundant resources of fuel, oil, minerals, and timber in Colorado, New Mexico, Utah, and Wyoming. Bureau of Reclamation photo.



River Basin project, Oregon; and the Colorado River Bridge on the Colorado River Storage project, Arizona.

Table 8 lists the major construction contracts (more than \$1 million) awarded by the Bureau of Reclamation in fiscal year 1957. The outstanding award for the fiscal year was for construction of the Glen Canyon Dam and powerplant, principal features of the Colorado River Storage project in Arizona. The contract is by far the largest contract awarded by the Bureau of Reclamation.

TABLE 9.—Major Bureau of Reclamation construction contracts awarded in fiscal year 1957

| Feature | Project | Amount of award |
|--|-----------------------------|-----------------|
| Glen Canyon Dam and powerplant..... | Colorado River Storage..... | \$107,955,522 |
| Trinity Dam..... | Central Valley..... | 48,928,100 |
| Clear Creek tunnel..... | do..... | 36,644,556 |
| Fremont Canyon powerplant and power conduit and 3 miles of tunnels..... | Missouri River Basin..... | 14,434,000 |
| Casitas Dam..... | Ventura River..... | 8,576,388 |
| Wahluke siphon, canal, and wasteway..... | Columbia Basin..... | 6,204,770 |
| 108 miles of Shafter-Wasco concrete pipe laterals..... | Central Valley..... | 5,638,539 |
| Colorado River Bridge..... | Colorado River Storage..... | 4,139,277 |
| Foundations and steel towers for 165 miles of Fargo-Granite Falls 230-kv. transmission line..... | Missouri River Basin..... | 3,097,440 |
| Right diversion tunnel at Glen Canyon Dam..... | Colorado River Storage..... | 2,452,340 |
| Anchor Dam and 3 miles of access road..... | Missouri River Basin..... | 2,289,052 |
| 12.7 miles of Putah South Canal and 0.5 mile of McCoy Creek wasteway..... | Solano..... | 2,143,907 |
| 2.6 miles Helena Valley tunnel..... | Missouri River Basin..... | 2,095,041 |
| Green Springs powerplant, switchyard, steel penstock, and road relocation..... | Rogue River Basin..... | 1,802,368 |
| 11.8 miles Howard Prairie Canal and Soda Creek Diversion Dam. Streets, utilities, residences, and buildings for Trinity Government community facilities..... | do..... | 1,636,739 |
| Surfacing 24.6 miles of access highway to Glen Canyon Dam and construction of Manson Mesa airstrip..... | Central Valley..... | 1,576,589 |
| Foundations and steel towers for 76 miles of Utica Junction-Sioux Falls 230-kv. transmission line..... | Colorado River Storage..... | 1,517,412 |
| 8.5 miles of Putah South Canal..... | Missouri River Basin..... | 1,316,411 |
| Earthwork and structures for 4.6 miles of access highway to Glen Canyon Dam..... | Solano..... | 1,186,826 |
| Completion of Glendo powerplant..... | Colorado River Storage..... | 1,156,244 |
| Howard Prairie Dam..... | Missouri River Basin..... | 1,120,447 |
| Helena Valley pumping plant..... | Rogue River Basin..... | 1,074,345 |
| 6.2 miles of Courtland Canal, 15 miles of Courtland laterals, and 13.8 miles of Miller laterals..... | Missouri River Basin..... | 1,056,383 |
| Earthwork and structures for 20 miles of access highway to Glen Canyon Dam and Waterholes Canyon Bridge..... | do..... | 1,014,168 |
| | Colorado River Storage..... | 1,011,820 |

Other features for which contracts were awarded were Trinity Dam and Clear Creek tunnel on the Central Valley project in California, the Fremont Canyon Powerplant and Power Conduit and Anchor Dam on the Missouri River Basin project in Wyoming, Casitas Dam on the Ventura River Basin project in California, the Wahluke Siphon, canal, and wasteway on the Columbia Basin project in Washington, and the Colorado River Bridge on the Colorado River Storage project in Arizona.

Listed in table 10 are the principal features completed on Bureau of Reclamation projects in fiscal year 1957. The table includes 2 storage dams, 35 pumping plants, 295 miles of canals, laterals, wasteways, and drains, 22 miles of aqueducts, and 526 miles of transmission lines.

TABLE 10.—*Principal features completed on Bureau of Reclamation projects in fiscal year 1957*

| Feature | Project | State |
|---|----------------------|--|
| 168 miles canals, laterals, wasteways, and drains. | Columbia Basin | Washington. |
| 20 pumping plants | do. | Do. |
| 34 miles of Kennewick main canal and laterals | Yakima | Do. |
| 60-mile 115-kv Palisades-Goshen transmission line. | Palisades | Idaho. |
| Fish collecting facilities for Delta-Mendota Canal intake. | Central Valley | California. |
| Diversion tunnel for Trinity Dam | do. | Do. |
| 6 miles Shafter-Wasco Irrigation District laterals. | do. | Do. |
| 6 miles Corning Canal | do. | Do. |
| 6 miles Putah South Canal. | Solano | Do. |
| 35 miles canals and laterals for Texas Hill and Ralph's Mill areas. | Gila | Arizona. |
| 7 pumping plants for Texas Hill and Ralph's Mill areas. | do. | Do. |
| Wanship Dam | Weber Basin | Utah. |
| 22 miles Davis and Weber Aqueducts. | do. | Do. |
| 7.6 miles Gateway Canal. | do. | Do. |
| Reconductoring 72 miles 115-kv. Elephant Butte-Socorro transmission line. | Rio Grande | New Mexico. |
| 10 miles Atrisco Feeder Canal. | Middle Rio Grande | Do. |
| 8 pumping plants for Hanover-Bluff unit. | Missouri River Basin | Wyoming. |
| 9 miles of Sargent Canal. | do. | Nebraska. |
| 13 miles of Kirwin Main Canal. | do. | Kansas. |
| Pactola Dam | do. | South Dakota. |
| 13 miles Fort Peck-Whately 69-kv. transmission line. | Fort Peck | Montana. |
| 376 miles 115-kv. transmission lines | Missouri River Basin | North Dakota, South Dakota, Wyoming, Nebraska. |
| 77 miles 230-kv. transmission lines. | do. | South Dakota. |

A significant event was start of construction in April 1957 of the second highest dam in the United States, the 700-foot high Glen Canyon Dam on the Glen Canyon Unit of the Colorado River Storage project in northcentral Arizona. The 5,063,000-cubic yard, concrete-arch structure and the 900,000-kilowatt Glen Canyon powerplant are being built on the Colorado River. Glen Canyon reservoir will have a capacity of 28,040,000 acre-feet.

During the fiscal year about 25 miles of highway were placed under construction to provide access to the remote dam site. Construction was also begun on the Colorado River Bridge which will span the Colorado River near the downstream toe of the dam. The steel arch bridge will be the highest and second longest of its type in the United States. Work on the new Government community of Page, Ariz., near the dam site was begun; contracts were awarded for water and sewerage systems and streets for the community.

On the Flaming Gorge unit of the Colorado River Storage project in Utah, preliminary work comprised construction of access roads, community facilities near the dam site, and a timber bridge spanning the Green River. Construction of the concrete-arch dam is planned to begin during fiscal year 1958.

Progress of Construction

On the Columbia Basin project in Washington, the irrigation system was extended to serve an additional 54,000 acres in fiscal year

1957, bringing to a total 301,000 acres available for irrigation. Completed were 168 miles of canals, laterals, wasteways, and drains, and 20 pumping plants. Construction began on the 15-foot diameter, 3-mile long Wahluke siphon, and construction advanced on the Burbank pumping plants No. 2 and 3, and on the Evergreen, Frenchman Springs, and White Bluffs pumping plants.

In Idaho, construction of the 270-foot high, 13,000,000-cubic yard, earthfill Palisades Dam on the Palisades project was essentially completed. The spillway, intake, and powerplant structures were completed and the outlet works were nearing completion at the end of the fiscal year. Two of the 28,500-kilowatt generators in the 114,000-kilowatt Palisades powerplant were placed in operation, and work continued on the installation of the remaining two generators, which are to "go on the line" during fiscal year 1958. Also in Idaho, construction of the American Falls pumping plant on the Michaud Flats project was about three-fourths completed by the end of the fiscal year, and work on the rehabilitation of the face of Black Canyon Dam on the Boise project was completed.

Construction progress in Oregon was noted by the advance to two-thirds completion of the Haystack Dam on the Deschutes project, and initiation of construction of the Howard Prairie Dam and Howard Prairie delivery canal, both on the Rogue River Basin project. Also on the Rogue River Basin project, a contract was awarded for construction of the Green Springs powerplant, which will be the Bureau's highest head powerplant. The 16,000-kilowatt plant will operate under an 1,800-foot head, some 600 feet higher than any existing Reclamation powerplant. Work continued on the rehabilitation and improvement of the existing structures of the Medford Irrigation District, including reconstruction of siphons, canals, and wasteways.

The 11,250-kilowatt Roza powerplant on the Yakima project in Washington was brought to 90 percent of completion at the end of the year. On the same project, alterations to the Prosser Diversion Dam were completed; several sections of the Kennewick main canal and laterals were also completed.

A major Bureau of Reclamation construction undertaking during the year was start of construction of the Trinity Dam on the Trinity River Division of the Central Valley project in California. The 510-foot high, 29,000,000-cubic yard dam will be one of the world's highest earthfill dams. The dam and other Division structures will ultimately make possible the average annual transbasin diversion of 865,000 acre-feet of surplus waters from the Trinity River watershed to the Central Valley Basin. Also placed under construction during the year was another major Division feature, the Clear Creek tunnel. The 10.8-mile long, 17.5-foot diameter tunnel will be the second longest tunnel constructed on a Reclamation project.

Other construction activities on the Central Valley project included completion of excavation of the 33-foot diameter diversion tunnel at Trinity Dam; completion of 6 miles of concrete pipe laterals for the Shafter-Wasco Irrigation District on the Friant-Kern Canal Distribution System; completion of a 6-mile section of the Corning Canal; and completion of the novel fish-collecting facilities at the intake to the Delta-Mendota Canal. Construction began on 108 miles of concrete pipe laterals for the Shafter-Wasco Irrigation District.

Dam construction was notable on three other projects in California. On the Solano project, the 304-foot high, concrete-arch Monticello Dam was essentially completed at year's end, and reservoir storage behind the dam was begun. Putah Diversion Dam on the same project was about 80 percent completed at the end of the year. The 285-foot high, 9,000,000-cubic-yard, earthfill Casitas Dam on the Ventura River project was placed under construction during the year. On the Santa Maria project, construction of the Vaquero Dam neared the midway point of completion; the dam is an earthfill structure having a height of 241 feet and a volume of about 5,830,000 cubic yards.

Good progress was made on construction of the Palo Verde Diversion Dam on the Colorado River between California and Arizona. This Palo Verde Diversion Project feature was about 75 percent completed by the end of the fiscal year. Work on the Gila project in Arizona was noted for completion of the irrigation distribution systems for the Texas Hill and Ralph's Mill areas of the Wellton-Mohawk Division.

In Utah, the earthfill Wanship Dam on the Weber Basin project was completed and the Slaterville Diversion Dam was essentially completed by year's end. The 5-mile long Weber aqueduct and the first 17-mile long section of the Davis aqueduct were completed. All structures and embankment for enlargement of the Pineview Dam were completed and installation of gates and equipment were essentially completed. Construction was started in April 1957 on the 1,400-kilowatt Wanship powerplant and the 4,000-kilowatt Gateway powerplant.

On the Provo River project in Utah, construction of the 5,000-kilowatt Deer Creek powerplant was brought to 60 percent completion.

In New Mexico, channelization of 17 miles of the Rio Grande River on the Middle Rio Grande project was completed during the year and an additional 15-mile reach of channelization was substantially completed. Also completed on the project were 10 miles of the Atrisco feeder canal, rehabilitation of the San Acacia diversion dam, and rehabilitation of the Belen unit 1 irrigation system and units 1 and 2 of the Socorro irrigation system.

Construction progress on the Missouri River Basin project was noted by completion of the 230-foot high Pactola Dam, an earthfill structure in South Dakota. In Wyoming, construction began on the 200-foot high, concrete-arch Anchor Dam. Work was also begun on the earthfill Helena Valley Dam and Helena Valley pumping plant in Montana. Construction of the 3-mile-long Helena Valley tunnel was about 30 percent completed by the end of the fiscal year.

Work on the Transmission Division of the Missouri River Basin project in North and South Dakota included completion of the 80-mile Fargo-Grand Forks 115-kv. transmission line and the 80-mile Edgeley-Groton 115-kv. line, and stringing of the last section of the 204-mile, 230-kv. Big Bend-Granite Falls transmission line. Contracts were awarded for start of construction of the 165-mile, 230-kv. Fargo-Granite Falls transmission line and the 67-mile, 230-kv. Utica Junction-Sioux Falls line. In Wyoming and Nebraska, the 201-mile, 115-kv. Alcova-Gering transmission line was completed.

In Wyoming the placing of the embankment for the earthfill Glendo Dam was 94 percent completed by the end of the fiscal year and will be completed early in fiscal year 1958. Construction continued on the 24,000-kilowatt Glendo powerplant. Work was started on the 48,000-kilowatt Fremont Canyon powerplant and power conduit. In the same State the Hanover and Bluff pumping plants and associated lateral systems were completed and placed in service.

In the Nebraska and Kansas areas of the Missouri River Basin project, work was continued on development of the project's irrigation facilities. Lovewell Dam on the Bostwick Division in Kansas neared completion and will be finished early in the next fiscal year. An 8-mile reach of the Courtland Canal, adjoining the outlet works of Lovewell Dam, was completed. Construction began on the 10-mile Courtland West Canal and lateral system. On the Frenchman-Cambridge Division the first 10-mile section of the Upper Meeker Canal connecting with the outlet works of Trenton Dam was essentially completed, and the 7½-mile second section of the canal and associated laterals and drains were about 50 percent completed. Completed on the Sargent unit was a 9-mile section of the Sargent Canal; work on the last 19-mile section of the Sargeant Canal and lateral system was brought to about 50 percent of completion. The 13-mile Kirwin Main Canal on the Kirwin unit was completed, and work continued on the 16-mile Kirwin South Canal.

Construction began in June 1957 on the 4,500-kilowatt Big Thompson powerplant on the Colorado-Big Thompson project in Colorado. The powerplant will bring the planned development of the project to completion.

Design Activities and Developments

Greater use of subprofessional staff members in routine design assignments, improved design techniques and greater utilization of automatic computing devices in design work resulted in design schedules being efficiently and promptly met despite difficulties imposed by a shortage of trained design engineers. Design specifications for 116 construction contracts and 91 major supply contracts were completed. The average cost for these engineering services as related to the overall Bureau of Reclamation construction and rehabilitation program for the 1957 fiscal year was 5.3 percent.

Use of an electronic digital computer greatly speeded up calculations of earthwork quantities in canal design. Excavation and compacted embankment quantities for a total of 122 miles of two canals were computed from original field data at a rate of up to 600 cross sections an hour. The calculations, which included a total of 4,000 cross sections and represented 6.4 million cubic yards of excavation and 1.6 million cubic yards of compacted embankments, were completed in 9 hours. Under conventional methods, the same computations would have required 4 man-months of design work.

Automatic machine methods for computation were similarly used in dams designed to effect considerable economy. For one phase of analysis of the stresses in Glen Canyon Dam, computations were completed on an automatic computer in less than 2 hours. The same analysis would have required about 40 man-days by conventional methods.

Designs for modifications and additions to the headworks and siphon spillway of the Chandler power and pumping plant on the Yakima project in Washington, included electroconductive rubber heating blankets to be installed in the plant's siphon spillway. The blankets have flexible rubber facings which hermetically seal a waterproof heating element. This was the Bureau's first use of the blankets to prevent adherence of ice to critical surfaces of powerplant appurtenances.

Use was made during the year of a new geophysical field technique at the Glen Canyon and Flaming Gorge dam sites. By detonating a small explosive charge on the rock at the dam sites, the subsequent vibrations in the rock, analyzed by geophysical seismic equipment, provided a means of measuring the elasticity and strength of the foundation and abutment rock under the influence of the loads imposed by the dams and the impounded water.

Three Bureau inventions were patented during the fiscal year. One invention permits precipitation measurements to be automatically transmitted by radio from unattended precipitation recording stations. Also patented was a device for detecting small amounts of water in insulating oils for electrical equipment, and an invention

which utilizes magnetic tape for power system oscillographic recording, rather than photographic film.

Considerable progress was made in investigating the possibilities of controlling evaporation from open reservoirs by the use of a monomolecular film—a floating invisible shield between air and water. A method was developed to detect the presence of monomolecular layers on reservoirs. An investigation of methods of applying hexadecanol was begun at Rattlesnake Reservoir on the Colorado-Big Thompson project in Colorado, preliminary to full-scale monomolecular layer experiments planned for Lake Hefner at Oklahoma City. Preliminary studies indicated that the toxicity of hexadecanol (cetyl alcohol) to specific elements of aquatic life, such as plants, fish, and waterfowl, would be insignificant. In a joint program conducted on a small lake in Oklahoma City, a 2-month trial of hexadecanol indicated no significant change in water quality or undesirable effects on lake biology.

In concrete research, a long-term study of the resistance of concrete to destructive sulfate attack confirmed that low tricalcium aluminate content in cement is the major factor contributing to sulfate resistance. The study also indicated that sulfate resistance for all cement types is increased by a corresponding decrease in the water-cement ratio. Research into the effect of vibration of air-entrained concrete disclosed that proper air content and thorough compaction are essential to optimum freezing and thawing resistance of the concrete.

Initial work was completed to find practicable methods of improving concrete by modifying the particle shape of the sand to be used in concrete. Treatment of a sand in the laboratory processing machines resulted in as much as 15 percent reduction in water requirement and a corresponding reduction in cement.

Hydraulic laboratory model studies of the Glen Canyon Dam spillways indicated that the preliminary design of the approach channels at the canyon edge could be reduced in width by 210 feet, which in turn will reduce the rock excavation by 440,000 cubic yards. Hydraulic studies for Trinity Dam showed that the lengths of the hollow-jet valve stilling basin and the center training wall could be considerably reduced and would result in better performance at reduced cost. Research into a high pressure, closed conduit indicated that cavitation damage to the conduit downstream from a partly opened gate valve could be virtually eliminated by increasing the diameter of the conduit downstream from the valve to 1.75 times the diameter of the valve.

As part of the Bureau's lower-cost canal lining program, laboratory studies and field trials were continued on sediment, soil-cement, earth, asphalt, plastic, and other types of linings for irrigation canals. It was found that the addition of only 2 to 4 percent of cement to

a sandy loess soil greatly increased erosion resistance, freezing and thawing durability, and unconfined compressive strengths.

New specifications were prepared for sediment lining and prefabricated asphaltic liners. Installations were made for field permeability tests to determine the effects of climatic conditions on compacted earth linings, and electrical methods for locating subsurface seepage paths from a canal were studied. A chemical test was developed for the rapid determination of the cement content of soil-cement mixture for canal lining; the test is to be used as a control during mixing operations.

In soils research, studies on stabilizing clay canal slopes indicated that a pronounced reduction in expansiveness is achieved by mixing 4 percent of hydrated lime or portland cement into the clay. Experimental stabilization of the slopes of an unlined reach of the Friant-Kern Canal, where expansive clay has caused sloughing, was begun by employing electrochemical techniques.

Research completed on the in-place measurement of the sediment density at Angostura Reservoir with an atomic radiation device showed the method to be feasible. The device was developed and tested for the Sedimentation Subcommittee of the Interagency Committee on Water Resources as a possible supplement to conventional sediment survey methods that involve removal and laboratory testing of sediment samples.

The measurements were made using gamma rays which radiated into the sediment from a piece of radioactive material in a probe that was lowered into the reservoir. The amount of scattering of the rays caused by the sediment was then recorded, giving a measure of the sediment density.

In weed control research, several samples of emulsifying agents were evaluated for suitability in producing stability in emulsions of aromatic solvent water weed killers. Further development was made in the test method devised for the evaluation of emulsifying agents. Equipment and procedures were developed to evaluate the efficacy of weed-killing chemicals under flowing water conditions. Specifications for purchasing aromatic solvent water weed killers were revised and improved.

During the year 116 laboratory reports were issued covering the subjects of research and testing of concrete materials, hydraulic laboratory studies, earth materials investigations, research in bituminous materials, structural studies, and protective coatings investigations.

Construction Costs

Construction costs on Bureau of Reclamation projects increased about 6.5 percent during fiscal year 1957. This increase was somewhat

less than in fiscal year 1956, when construction costs on Reclamation projects increased about 8.5 percent.

Bidding interest in all types of reclamation construction work showed a slight increase over the preceding year, rising from an average of 5.4 bids per construction schedule in fiscal year 1956, to about 5.8 bids in fiscal year 1957.

The following table shows cost indexes for Bureau of Reclamation construction work based on the combined costs of materials and labor supplied by contractors and materials and labor supplied by the Government.

TABLE 11.—*Bureau of Reclamation construction indexes, fiscal year 1957*

| Cost indexes based on January 1940 costs=1.00 | July 1956 | January 1957 | June 1957 |
|---|--------------|-----------------|--------------|
| Dams: | | | |
| Earth..... | 2.26 | 2.30 | 2.38 |
| Concrete..... | 2.30 | 2.34 | 2.41 |
| Pumping plants: | | | |
| Building and equipment..... | 2.82 | 2.95 | 2.99 |
| Structures and improvements* | 2.96 | 3.03 | 3.05 |
| Equipment..... | 2.62 | 2.82 | 2.86 |
| Pumps and prime movers..... | 2.77 | 2.95 | 2.99 |
| Accessory electric and miscellaneous equipment..... | 2.42 | 2.62 | 2.66 |
| Steel penstocks and discharge pipes..... | 3.33 | 3.62 | 3.66 |
| Canals and conduits: | | | |
| Canals..... | 2.44 | 2.55 | 2.59 |
| Conduits (tunnels, free flow, concrete lined)..... | 2.78 | 2.80 | 2.85 |
| Laterals and drains..... | 2.90 | 3.05 | 3.17 |
| Powerplants, hydro: | | | |
| Building and equipment..... | 2.71 | 2.85 | 2.89 |
| Structures and improvements* | 2.92 | 2.96 | 2.99 |
| Equipment..... | 2.64 | 2.80 | 2.84 |
| Turbines and generators..... | 2.63 | 2.83 | 2.84 |
| Accessory electrical equipment..... | 2.47 | 2.65 | 2.69 |
| Miscellaneous equipment..... | 2.61 | 2.79 | 2.81 |
| Concrete pipelines..... | 2.21 | 2.32 | 2.32 |
| Transmission switchyards and substations..... | 2.72 | 2.94 | 2.96 |
| Transmission lines (wood pole 115-kv.)..... | 2.20 | 2.20 | 2.20 |
| Transmission lines (steel tower 230-kv.)..... | 2.54 | 2.62 | 2.65 |
| Permanent general property buildings..... | 2.92 | 2.94 | 2.94 |
| Roads and bridges: | | | |
| Primary roads..... | 2.41 | 2.48 | 2.56 |
| Secondary roads, unsurfaced..... | 2.14 | 2.24 | 2.34 |
| Bridges (steel)..... | 3.05 | 3.20 | 3.23 |
| Composite index..... | 2.52 | 2.63 | 2.69 |

*Indexes for structures and improvements on pumping plants and powerplants are based on a reinforced concrete structure.

Foreign Manufacturers

Twenty-six contracts, principally for electrical equipment, were awarded to companies offering equipment manufactured outside the United States. These contracts, which totaled \$1,387,693, included 11 English, 8 Italian, 3 Swiss, 1 West Germany, and 3 Austrian firms. A differential of 6 percent was added to all foreign bids before comparison was made with domestic bids, in accordance with departmental regulations applying to determinations under the "Buy American Act." An additional 6 percent differential was added if the low domestic bidder indicated that equipment or materials would be produced in an area of substantial labor surplus, as determined by the Secretary of Labor.

TABLE 12.—Bureau of Reclamation storage dams, June 30, 1957

| State and project | Name of dam | River | Type | Capacity (acre feet) | Height (feet) | Length (feet) | Volume (cubic yards) | Year |
|------------------------|---------------------|--------------------|--|-------------------------|------------------|------------------|----------------------------|------------------|
| Alaska: | | | | | | | | |
| Eklutna | Eklutna | Eklutna Creek | Earth | 182, 100 | 26 | 555 | 5, 000 | 2 1955 |
| Arizona: | | | | | | | | |
| Colorado River Storage | Glen Canyon | Colorado | Concrete arch | 28, 040, 000 | 700 | 1, 580 | 5, 063, 000 | (¹) |
| Salt River | Bartlett | Verde | Concrete multiple arch | 179, 500 | 287 | 800 | 182, 000 | 1939 |
| | Horse Mesa | Salt | Concrete arch | 245, 100 | 305 | 660 | 162, 000 | 2 1937 |
| | Mormon Flat | do. | do. | 57, 900 | 224 | 380 | 59, 900 | 2 1938 |
| | Roosevelt | do. | Masonry arch | 1, 381, 600 | 280 | 723 | 355, 800 | 1911 |
| | Stewart Mountain | do. | Concrete arch | 69, 800 | 207 | 1, 260 | 120, 500 | 2 1936 |
| Arizona-California: | | | | | | | | |
| Parker-Davis | Parker ³ | Colorado | do. | 716, 600 | 320 | 856 | 380, 000 | 1938 |
| Arizona-Nevada: | | | | | | | | |
| Boulder Canyon | Hoover | do. | Concrete arch-gravity | 29, 827, 000 | 726 | 1, 244 | 4, 400, 000 | 1936 |
| Parker-Davis | Davis | do. | Earth and rock | 1, 818, 300 | 200 | 1, 600 | 4, 357, 500 | 1950 |
| California: | | | | | | | | |
| Cachuma | Cachuma | Santa Ynez | Earth | 204, 900 | 275 | 3, 289 | 6, 695, 272 | 1953 |
| | Glen Anne | Glen Anne Canyon | do. | 500 | 102 | 240 | 323, 343 | 1953 |
| | Lauro | Diablo Creek | do. | 642 | 110 | 540 | 499, 223 | 1952 |
| | Folsom ⁴ | American | Concrete gravity, embankment wings | 1, 010, 300 | 340 | 10, 200 | 9, 010, 000 | 1955 |
| Central Valley: | | | | | | | | |
| | Friant ³ | San Joaquin | Concrete gravity | 520, 500 | 319 | 3, 488 | 2, 135, 000 | 1942 |
| | Keswick | Sacramento | Concrete gravity, embankment wings | 23, 800 | 159 | 1, 046 | 197, 000 | 1950 |
| | Martinez | Offstream | Earth | 265 | 62 | 1, 200 | 183, 450 | 1947 |
| | Nimbus | American | Concrete gravity | 8, 800 | 76 | 1, 093 | 121, 065 | 1955 |
| | Shasta | Sacramento | Concrete curved-gravity, embankment wing | 4, 500, 000 | 602 | 3, 460 | 8, 711, 000 | 1945 |
| | Sly Park Main Dam | Sly Park Creek | Earth | 41, 000 | 190 | 760 | 1, 290, 600 | 1955 |
| | Sly Park Saddle Dam | Offstream | do. | 2, 500, 000 | 130 | 600 | 29, 100, 000 | 1955 |
| Orland: | | | | | | | | |
| | Trinity | Trinity | Earth, gravel and rock | 50, 900 | 510 | 2, 450 | 12, 202 | (⁵) |
| | East Park | Little Stony Creek | Concrete arch-gravity | 150, 000 | 139 | 266 | 43, 135 | 1910 |
| | Stony Gorge | Stony Creek | Concrete slab-and-buttress | 239, 000 | 139 | 868 | 5, 833, 000 | 1928 |
| Santa Maria: | Vaquero | Cuyama | Earth | 1, 600, 000 | 241 | 1, 800 | 325, 000 | (⁵) |
| Solano: | Monticello | Putah Creek | Concrete arch | 33, 800 | 304 | 1, 010 | 920, 000 | (⁵) |
| Colorado: | | | | | | | | |
| Collbran | Vega | Plateau Creek | Earth and rock | 112, 200 | 150 | 2, 035 | 2, 547, 388 | (⁵) |
| Colorado-Big Thompson | Carter Lake No. 1 | Offstream | Earth | 75 | 214 | 1, 235 | 321, 174 | 1952 |
| | Carter Lake No. 2 | do. | do. | 55 | 75 | 1, 150 | 211, 852 | |
| | Carter Lake No. 3 | do. | do. | 240 | 75 | 1, 425 | 211, 852 | |
| | Dixon Canyon | do. | do. | 155 | 155 | 1, 265 | 2, 961, 350 | 1949 |
| | Horseshoe | do. | do. | 226 | 155 | 1, 840 | 91, 871, 000 | 1949 |
| | Soldier Canyon | do. | do. | 226 | 1, 438 | 1, 438 | 3, 212, 000 | 1949 |
| | Spring Canyon | do. | do. | 220 | 1, 120 | 1, 120 | 2, 095, 000 | 1949 |

| | | | | | | | |
|------------------------|------------------------|------------------------------------|-----------|-----|--------|------------|-------------------|
| Flatiron..... | Chimney Hollow Creek | do. | 760 | 86 | 1,725 | 381,500 | 1953 |
| Granby..... | Colorado. | do. | 539,800 | 298 | 861 | 2,974,000 | 1950 |
| Green Mountain..... | Bite | do. | 154,000 | 309 | 1,150 | 4,360,000 | 1943 |
| Marys Lake Dike No. 1. | Offstream | do. | 900 | 29 | 820 | 90,300 | 1949 |
| Marys Lake Dike No. 2. | do | do. | 3,100 | 35 | 950 | 311,600 | 1949 |
| Olympus..... | Big Thompson | Earth, concrete overflow section | 2,180 | 70 | 1,951 | 432,000 | 1949 |
| Rattlesnake..... | Rattlesnake Creek | Earth | 18,400 | 130 | 1,100 | 3,077 | 1952 |
| Shadow Mountain | Colorado. | do. | 10,000 | 127 | 1,100 | 392,400 | 1946 |
| Willow Creek..... | Willow Creek | do. | 4,000 | 55 | 1,520 | 135,500 | 1938 |
| Fruitgrowers Dam. | Alfalfa Run | do. | 10,000 | 180 | 1,900 | 1,710,000 | 1949 |
| Mancos..... | Offstream | do. | 129,700 | 162 | 4,010 | 3,738,000 | 1941 |
| Pine River..... | Los Pinos | do. | 60,000 | 165 | 1,475 | 912,000 | 1951 |
| San Luis Valley | Conchos | do. | 1106,200 | 206 | 675 | 1,115,000 | 1937 |
| Uncompahgre..... | Taylor | do. | 493,200 | 456 | 1,350 | 9,653,000 | 1950 |
| Idaho-Oregon: | Boise, South Fork | Earth | 286,600 | 350 | 1,150 | 395,000 | 1915 |
| Boise..... | Boise | Concrete arch-gravity | 704,100 | 107 | 785 | 56,360 | 1948 |
| Arrowrock..... | Payette, North Fork | Earth | 161,800 | 165 | 749 | 1,243,000 | 1931 |
| Cascade..... | Deadwood | Concrete arch-gravity | 190,100 | 46 | 7,200 | 1,240,000 | 1908 |
| Deadwood..... | Offstream | Earth | 1,700,000 | 94 | 5,227 | 313,600 | 1927 |
| Deer Flat, upper | do | do. | 15,400 | 118 | 1,170 | 539,000 | 1939 |
| Deer Flat, lower | Snake | Concrete-gravity embankment wings | 127,800 | 91 | 9,448 | 564,000 | 1938 |
| American Falls | Grassy Creek | Earth and rock | 847,000 | 78 | 4,920 | 491,700 | 1911 |
| Grassy Lake..... | Snake, Henrys Fork | do. | 210,000 | 86 | 4,475 | 257,300 | 1906 |
| Island Park..... | Snake | Concrete gravity, embankment wings | 1,402,000 | 270 | 2,100 | 13,571,000 | (⁵) |
| Jackson Lake..... | do | Earth | 377,000 | 202 | 12,560 | 8,490,000 | 1951 |
| Minidoka ³ | Snake, South Fork | do. | 314,600 | 169 | 12,646 | 9,537,000 | 1955 |
| Palisades..... | Smoky Hill | do. | 260,700 | 154 | 10,600 | 8,145,000 | 1956 |
| Cedar Bluff..... | Solomon, North Fork | do. | 170,200 | 158 | 9,200 | 8,853,000 | 1951 |
| Kirwin..... | Solomon, South Fork | do. | 94,000 | 93 | 8,500 | 3,190,000 | (⁵) |
| Webster..... | Republican, South Fork | do. | 36,000 | 65 | 2,550 | 1,114,000 | ² 1954 |
| Bonny..... | White Rock Creek | do. | 2,051,000 | 225 | 1,000 | 414,000 | 1954 |
| Lovewell..... | Rock Creek | Concrete gravity | 10,560 | 91 | 2,880 | 303,000 | (⁵) |
| Como..... | Missouri River | Earth | 3,468,000 | 564 | 2,115 | 3,068,200 | 1953 |
| Canyon Ferry..... | Offstream | Concrete arch | 400 | 42 | 1,050 | 142,800 | 1937 |
| Holena Valley..... | Flathead, South Fork | Earth | | | | | |
| Hungry Horse..... | Offstream | Earth | | | | | |
| Huntley..... | | | | | | | |

See footnotes at end of table.

TABLE 12.—Bureau of Reclamation storage dams, June 30, 1957—Continued

| State and project | Name of dam | River | Type | Capacity (acre feet) | Height (feet) | Length (feet) | Volume (cubic yards) | Year |
|--|-------------------|----------------------------------|---|-------------------------|------------------|------------------|----------------------------|------|
| Montana—Continued Lower Marias Unit (Mis- souri River Basin). Milk River. | Tiber. | Marias | Earth. | 1,337,000 | 205 | 4,300 | 9,290,000 | 1936 |
| | Tiber Dike. | do. | do. | | 60 | 17,000 | 1,740,000 | 1936 |
| | Fresno | Milk | do. | 129,100 | 111 | 2,070 | 2,105,000 | 1939 |
| | Nelson Dikes. | Offstream | do. | 85,500 | 28 | 9,900 | 232,600 | 1915 |
| | Shorburne Lake. | Swift Current Creek | do. | 66,100 | 96 | 1,086 | 227,600 | 1921 |
| Sun River. | Gibson | Sun, North Fork | Concrete arch | 105,000 | 199 | 960 | 167,530 | 1929 |
| | Pishkun Dikes. | Offstream | Earth | 46,300 | 12-50 | 9,050 | 399,300 | 1921 |
| | Willow Creek | Willow Creek | do. | 32,400 | 93 | 650 | 275,000 | 1911 |
| | Enders. | Frenchman Creek | Earth | 74,500 | 134 | 2,603 | 1,951,000 | 1930 |
| | Medicine Creek. | Medicine Creek | do. | 90,900 | 165 | 5,665 | 2,676,000 | 1949 |
| Nebraska—Cambridge Division (Missouri River Basin). Mirage Flats. | Trenton. | Republican | do. | 254,000 | 144 | 8,600 | 7,737,000 | 1933 |
| | Box Butte | Niobrara | do. | 31,100 | 87 | 5,508 | 1,422,000 | 1946 |
| | Guernsey. | North Platte. | do. | 44,800 | 135 | 560 | 586,000 | 1927 |
| | Lake Alice, upper | Offstream | do. | 11,200 | 30 | 3,100 | 240,600 | 1912 |
| | Lake Alice, lower | do. | do. | | 23 | 2,550 | 119,000 | 1913 |
| Nebraska—Wyoming: North Platte | Minutaur | do. | Earth and gravel, concrete-faced | 62,200 | 63 | 3,700 | 169,100 | 1915 |
| | Pathfinder. | North Platte | Masonry arch | | 214 | 432 | 65,700 | 1909 |
| | Pathfinder Dike. | do. | Earth | 1,015,900 | 38 | 1,650 | 152,000 | 1909 |
| | Rye Patch. | Humboldt | do. | 190,000 | 75 | 914 | 356,000 | 1936 |
| | Lahontan. | Carson | Earth and gravel. | 290,900 | 162 | 5,400 | 733,100 | 1915 |
| Nevada: Humboldt Nevada-California: Newlands. | Lake Tahoe. | Truckee | Concrete slab-and-buttress, sluice- way regulator. | 732,000 | 16 | 109 | 425 | 1913 |
| | Boca | Little Truckee | Earth | 41,100 | 116 | 1,629 | 912,000 | 1939 |
| | Alamogordo. | Pecos | do. | 122,100 | 164 | 3,084 | 2,250,000 | 1937 |
| | Avalon. | do. | Earth and rock, concrete core wall. | 6,000 | 58 | 1,025 | 202,300 | 1907 |
| | McMillan | do. | Earth and rock | 32,300 | 57 | 2,114 | 234,000 | 1908 |
| Middle Rio Grande Vermejo. | El Vado. | Rio Chama. | Earth, steel-faced. | 194,500 | 175 | 1,300 | 608,000 | 1955 |
| | Dam No. 2 | Offstream | Earth | 2,900 | 12 | 10,730 | 206,000 | 1954 |
| | Dam No. 13 | do. | do. | 5,000 | 32 | 8,237 | 248,000 | 1954 |
| | Stubblefield | do. | do. | 16,200 | 47 | 15,569 | 9,827,000 | 1954 |
| | Caballo. | do. | do. | 340,900 | 112 | 4,558 | 1,244,000 | 1938 |
| New Mexico—Texas: Rio Grande. | Elephant Butte | do. | Concrete straight gravity | 2,185,400 | 301 | 1,674 | 629,500 | 1916 |
| | Picacho North. | Picacho Arroyo, North Branch. | Earth | 6,790 | 45 | 1,600 | 148,600 | 1953 |
| | Picacho South. | Picacho Arroyo, South Branch. | do | 6,460 | 29 | 1,680 | 85,940 | 1954 |

| State | Unit | Structure | Material | Length, ft. | Area, sq. ft. | Volume, cu. ft. | Year |
|--------------------|---|----------------------|---|-------------|---------------|-----------------|------------------|
| North Dakota: | Dickinson..... | Heart River..... | do..... | 16,500 | 62 | 2,275 | 1950 |
| | Heart Butte..... | do..... | do..... | 225,500 | 142 | 1,850 | 1949 |
| | Jamestown..... | James..... | do..... | 230,000 | 110 | 1,418 | 1953 |
| | Altus ³ | Red, North Fork | Concrete gravity, masonry-faced | 164,300 | 110 | 1,112 | 1945 |
| | Thief Valley..... | Powder..... | Concrete slab-and-buttress | 17,600 | 73 | 390 | 1932 |
| | Burnt River..... | Burnt..... | Earth and rock | 25,800 | 83 | 694 | 1938 |
| | Crescent Lake..... | Crescent Lake | Earth | 86,000 | 40 | 450 | 1950 |
| | Crane Prairie..... | Crane Prairie | Earth and rock | 55,300 | 36 | 285 | 1940 |
| | Haystack..... | Haystack | Earth | 6,600 | 105 | 1,200 | (⁴) |
| | Wickiup..... | Wickiup | do..... | 187,300 | 100 | 13,800 | 1949 |
| Oklahoma: | Ochocho..... | Ochocho Creek | do..... | 47,500 | 125 | 1,350 | 2 1950 |
| | Rogue River Basin..... | Four Mile Lake | Rock, concrete facing | 19,500 | 50 | 1,150 | 2 1956 |
| | Umatilla..... | Fish Lake | Earth and rock | 7,880 | 88 | 990 | (⁵) |
| | Vale..... | McKay | Gravel, concrete-faced | 50,000 | 98 | 3,450 | 1908 |
| | Agency Valley..... | McAlhaur, North Fork | Earth | 73,800 | 165 | 2,364,000 | 1927 |
| | Warm Springs..... | Malheur, Middle Fork | Concrete arch | 60,000 | 110 | 1,850 | 1935 |
| | Clear Lake..... | Lost..... | Earth and rock | 192,400 | 106 | 469 | 1919 |
| | Gerber..... | Miller Creek | Concrete arch | 526,800 | 39 | 840 | 1910 |
| | Link River..... | Link | Reinforced concrete slab | 94,300 | 88 | 485 | 1925 |
| | Owyhee ³ | Owyhee | Concrete arch-gravity, straight gravity right wing. | 873,300 | 22 | 435 | 1921 |
| South Dakota: | Angostura..... | Cheyenne..... | Concrete gravity, embankment wing | 1,120,000 | 417 | 833 | 1932 |
| | Belle Fourche..... | Owl Creek..... | Earth, concrete-faced | 160,000 | 193 | 2,030 | 1949 |
| | Rapid Valley..... | Pierfield | Earth | 192,000 | 122 | 6,292 | 1911 |
| | Shadhill unit (Missouri River Basin)..... | Pactola..... | do..... | 15,700 | 133 | 825 | 1946 |
| Texas: | Shadhill unit (Missouri River Basin)..... | Grand..... | do..... | 90,000 | 230 | 1,255 | 1956 |
| | Colorado River..... | Colorado (Texas) | Concrete straight gravity, embankment wings. | 358,000 | 145 | 12,843 | 1951 |
| Utah: | Hyrum..... | Little Bear | Earth..... | 2,200,200 | 278 | 5,093 | 1942 |
| | Moon Lake..... | Offstream..... | do..... | 18,800 | 116 | 540 | 1935 |
| | Newton..... | do..... | do..... | 5,800 | 54 | 663 | 1937 |
| | Stofield..... | Lake Fork, West Fork | do..... | 49,500 | 21 | 2,575 | 1938 |
| Oregon-California: | Provo River..... | Clarkston Creek | do..... | 5,600 | 101 | 1,108 | 1938 |
| | Stofield..... | Provo | do..... | 152,600 | 235 | 3,340 | 1946 |
| | Stofield..... | Price..... | do..... | 73,600 | 125 | 1,304 | 1941 |
| | Stofield..... | Price..... | do..... | 73,600 | 125 | 575 | 1946 |

See footnotes at end of table.

TABLE 12.—Bureau of Reclamation storage dams, June 30, 1937—Continued

| State and project | Name of dam | River | Type | Capacity (acre feet) | Height (feet) | Length (feet) | Volume (cubic yards) | Year |
|----------------------------|---------------------------------------|-----------------------|---------------------------|-------------------------|------------------|------------------|----------------------------|------------------|
| Utah—Continued | Strawberry | Strawberry | Earth, concrete core wall | { | 72 | 490 | 118,000 | 1913 |
| | Indian Creek Dike | do. | do. | | 37 | 1,311 | 114,000 | 1913 |
| | Pineview ¹⁰ | Ogden | do. | | 132 | 600 | 418,000 | 1937 |
| | Weber Basin | Weber | Earth | | 156 | 2,010 | 3,021,000 | 1937 |
| | Echo | do. | do. | { | 158 | 1,887 | 1,540,000 | 1931 |
| | Webster River | do. | do. | | | | | |
| | Dry Falls | Offstream | do. | | 123 | 9,800 | 1,658,000 | 1949 |
| | North | do. | do. | | 145 | 1,450 | 1,473,000 | 1954 |
| | Grand Coulee | Columbia | Concrete gravity | | 550 | 4,173 | 10,585,000 | 1921 |
| | Long Lake | Offstream | Earth | | 130 | 1,960 | 1,462,000 | 1948 |
| Washington: Columbia Basin | O'Sullivan | Lower Crab Creek | do. | { | 200 | 19,000 | 8,753,000 | 1949 |
| | Soda Lake Dike | Soda Lake | do. | | 61 | 1,750 | 216,000 | 1952 |
| | Conconully | Salmon Creek | do. | | 70 | 1,000 | 359,000 | 1910 |
| | Salmon Lake | Offstream | do. | | 42 | 1,260 | 195,000 | 1921 |
| | Bumping Lake ³ | Bumping | do. | | 45 | 2,925 | 252,600 | 1910 |
| | Clear Creek ³ | Tieton, North Fork | Concrete arch | | 84 | 404 | 5,770 | 1914 |
| Okanogan | Cle Elum | Cle Elum | Earth | { | 160 | 1,801 | 1,411,000 | 1933 |
| | Kachess | Kachess | Earth and gravel | | 114 | 1,400 | 200,000 | 1912 |
| | Keechelus | Yakima | do. | | 103 | 6,550 | 683,500 | 1917 |
| | Tieton | Tieton | do. | | 235 | 920 | 2,049,000 | 1925 |
| | Boysen | Big Horn | Earth, concrete core wall | | | | | |
| | Big Sandy | Big Sandy Creek | Earth and rock | | 220 | 1,143 | 1,527,400 | 1952 |
| Wyoming: | Eden | North Platte | do. | { | 85 | 2,350 | 840,000 | 1952 |
| | Glendo unit (Missouri River Basin) | do. | Earth | | 212 | 1,947 | 3,051,000 | (⁵) |
| | Kendrick | do. | do. | | | | | |
| | Alcoeva ³ | do. | do. | | 265 | 763 | 1,635,000 | 1936 |
| | Seminole | do. | Concrete arch | | 295 | 530 | 210,000 | 1939 |
| | Keyhole | Belle Fourche | Earth | | 168 | 3,420 | 1,335,000 | 1952 |
| Missouri | Kortes unit (Missouri River Basin) | North Platte | Concrete straight gravity | { | 244 | 440 | 147,000 | 1951 |
| | Owl Creek unit (Missouri River Basin) | do. | do. | | | | | |
| | Anchor | Owl Creek, South Fork | Concrete arch | | 200 | 550 | 63,000 | (⁵) |
| | Bull Lake | Bull Lake Creek | Earth | | | | | |
| | Pilot Butte Dam No. 1 | Offstream | do. | | 81 | 3,456 | 819,600 | 1938 |
| | Pilot Butte Dam No. 2 | do. | do. | | 51 | 1,300 | 135,300 | 1926 |
| River Basin: | Pilot Butte Dam No. 3 | do. | do. | { | 25 | 1,200 | 50,500 | 1926 |
| | | | | | 12 | 3,400 | 19,200 | 1926 |

| | 1910 | 1918 | 1908 |
|-------------------|------|---------|-------|
| Wyoming-Montana: | | | |
| Shoshone..... | 200 | 1,300 | 2,200 |
| Buffalo Bill..... | 325 | 439,800 | |
| Deaver..... | 14 | 680 | |
| Ralston..... | 35 | 1,500 | |
| Concrete arch. | | | |
| Earth..... | | | |
| do..... | | | |

DEFINITIONS

Capacity: Total reservoir storage to highest controlled water surface, except where indicated by footnote 1.

Height: Distance between lowest point in foundation and normal crest of dam.

Length: Extent of barrier in dam and integral features constructed between natural abutments.

Volume: Space occupied by all material in dam and its appurtenant features.

Year: Date original construction was completed by Bureau of Reclamation, except as indicated in footnote 2.

¹ Live storage—dead storage not evaluated.

² Non-Reclamation construction. Date is of supplemental construction by Bureau of Reclamation.

³Storage and diversion.

⁵ Under construction.

⁶ For flood retention only.

⁷ Non-Reclamation construction. Bureau purchased half-interest in 1926.

Greater part of active storage behind O'Sullivan provided through wasteways from primary irrigation features of project.

⁹ Includes dike.

¹⁰ Constricted under Ogden River project, enlarged under Weber Basin project.

¹¹ Total eight dikes.

TABLE 13.—Bureau of Reclamation diversion dams, June 30, 1957

| State and project | Name of dam | River | Type | Capacity (acre-feet) | Height (feet) | Length (feet) | Volume (cubic yards) | Year |
|---|------------------------------|----------------------|--|-------------------------|------------------|------------------|----------------------------|------------------|
| Arizona: | | | | | | | | |
| Salt River | Granite Reef | Salt | Concrete ogee weir, embankment wings. | 3,600 | 18 | 1,128 | 35,000 | 1908 |
| | Joint Head Power Canal | do | Concrete weir, embankment wing | 200 | 4 | 2,600 | 5,400 | 1914 |
| | | do | do | 220 | 8 | 862 | 16,000 | 1906 |
| Arizona-California: | | | | | | | | |
| Gila and Boulder Can- yon, All American Canal System. | Imperial | Colorado | Concrete slab-and-buttress, over- flow section. | 17,155 | 23 | 3,475 | 196,790 | 1938 |
| Palo Verde | Palo Verde | do | Earth, concrete gate structure | 1,800 | 15 | 1,300 | 214,500 | (^a) |
| Yuma | Laguna | do | Rockfill weir, concrete-surfaced | 2,000 | 10 | 4,780 | 486,800 | 1909 |
| California: | | | | | | | | |
| Central Valley | Camp Creek | Camp Creek | Concrete weir | 500 | 20 | 119 | 1,721 | 1953 |
| | North | Stony Creek | Concrete weir, removable crest | 125 | 3 | 375 | 650 | 1913 |
| Orland | Rainbow | do | Concrete arch, overflow | 200 | 29 | 271 | 1,777 | 1914 |
| | South | do | Concrete weir | 225 | 2 | 895 | 3,640 | 1916 |
| | Putah | Putah Creek | Concrete and earth | 956 | 25 | 900 | 32,640 | (^c) |
| Solano | | | | | | | | |
| Colorado: | | | | | | | | |
| Colorado-Big Thompson | East Portal | Wind | Rock, concrete core wall | 550 | 10 | 245 | | 1947 |
| | Horseshoe Supply | Big Thompson | Concrete box | 600 | 8 | 90 | 1,300 | 1950 |
| | Little Hell Creek | Little Hell Creek | Earth and rock | 550 | 33 | 220 | 10,000 | 1952 |
| | North Poudre Supply Canal | Cachia la Poudre | Concrete weir, embankment wing | 250 | 6 | 200 | 1,300 | 1952 |
| | Pole Hill Afterbay | Little Hell Creek | Earth and rock | 550 | 21 | 220 | 6,000 | 1953 |
| | South Platte Supply Canal | Boulder Creek | Concrete weir | 230 | 5 | 64 | | 1956 |
| | Willow Creek Pump Forebay | Offstream | Earth and rock | 450 | 11 | 580 | 15,000 | 1953 |
| Fruitgrowers Dam | Dry Creek | Dry Creek | Concrete, overflow weir. | 100 | 5 | 36 | 242 | 1940 |
| Grand Valley | Grand Valley | Colorado | Concrete ogee weir | 1,675 | 14 | 546 | 17,990 | 1916 |
| Paonia | Fire Mountain | Gunnison, North Fork | Timber sheet piling, rockfill | 180 | 11 | 187 | 2,458 | 1950 |
| Uncompahgre | East Canal | Uncompahgre | Concrete weir, embankment wing | 330 | 8 | 701 | 1,009 | 1915 |
| | Garnet | do | Rockfill weir, concrete-surfaced | 75 | 4 | 375 | 500 | 1914 |
| | Gunnison | Gunnison | Timber-crib weir, concrete wings, removable crest. | 1,000 | 10 | 244 | 3,200 | 1912 |
| | Ironstone | Uncompahgre | Concrete gate structure, concrete wing. | 370 | 8 | 330 | 155 | 1915 |
| | Loutsenhizer | do | pile and timber weir, concrete apron. | 290 | 9 | 314 | 400 | 1911 |
| | Montrose and Delta | do | Concrete crest, concrete apron | 563 | 12 | 368 | 2,195 | 1915 |
| | Selig | do | Pile and timber weir, removable crest and concrete apron. | 300 | 10 | 96 | 500 | 1914 |

TABLE 13.—Bureau of Reclamation diversion dams, June 30, 1957—Continued

| State and project | Name of dam | River | Type | Capacity (acre-feet) | Height (feet) | Length (feet) | Volume (cubic yards) | Year |
|--|----------------------------|---------------------------|---|-------------------------|------------------|------------------|----------------------------|--------|
| New Mexico: Fort Sumner..... Middle Rio Grande | Fort Sumner..... | Pecos..... | Concrete gravity weir, overflow | 190 | 11 | 715 | 27,258 | 1951 |
| | Anostura..... | Rio Grande..... | Concrete wall weir..... | | 5 | 800 | 1,538 | (5) |
| | Isleta..... | do..... | Concrete, gate structure..... | 1,051 | 5 | 674 | 3,874 | 2 1955 |
| | San Acacia..... | do..... | do..... | 265 | 8 | 700 | 2,710 | 2 1956 |
| | Vermejo..... | Vermejo..... | Concrete weir, overflow, embankment wing. | 600 | 5 | 1,021 | 4,428 | 2 1955 |
| New Mexico-Texas: Rio Grande..... | Leasburg..... | Rio Grande..... | Concrete weir, embankment wings..... | 700 | 7 | 2,865 | 22,500 | 1907 |
| | Mesilla..... | do..... | do..... | 965 | 10 | 303 | 23,600 | 1916 |
| | Percha..... | do..... | do..... | 350 | 10 | 420 | 43,238 | 1917 |
| | Percha Arroyo..... | Percha Arroyo..... | Earth, rock-faced..... | 30,000 | 19 | 2,489 | 192,884 | 1939 |
| | Riverside..... | Rio Grande..... | Concrete weir, embankment wings..... | 1,000 | 6 | 283 | 145,150 | 1928 |
| Oregon: Deschutes..... Grants Pass..... Umatilla..... | North Canal..... | Deschutes..... | Concrete arch-gravity, overflow..... | 1,000 | 28 | 293 | 4,900 | (5) |
| | Savage Rapids..... | Rogue..... | Concrete gravity and multiple arch..... | 207 | 30 | 456 | 5,600 | 2 1955 |
| | Feed Canal..... | Umatilla..... | Concrete, rock, and timber weir, embankment wing. | 350 | 4 | 2,100 | 14,110 | 1907 |
| | Maxwell..... | do..... | Concrete and timber-crib weir, embankment wing. | 140 | 4 | 400 | 464 | 1912 |
| | Three Mile Falls..... | do..... | Concrete multiple arch..... | 300 | 23 | 915 | 5,068 | 1914 |
| Vale..... | Harper..... | Malheur..... | Concrete gate structure, embankment wing. | 662 | 12 | 914 | 9,258 | 1929 |
| | Lost River..... | Lost..... | Concrete multiple arch, overflow, embankment wings. | 3,000 | 26 | 675 | 19,915 | 1912 |
| | Lower Lost River..... | do..... | Reinforced concrete slab-and-buttress. | 810 | 12 | 324 | 689 | 1921 |
| | Malone..... | do..... | Concrete gate structure, embankment wing. | 220 | 18 | 515 | 21,200 | 1923 |
| | Miller..... | Miller Creek..... | Concrete weir, removable crest, embankment wing. | 190 | 5 | 290 | 1,615 | 1924 |
| South Dakota: Belle Fourche..... Texas: Balmorhea..... Utah: Moon Lake..... Provo River..... | Belle Fourche..... | Belle Fourche..... | Concrete weir, embankment wings..... | 1,035 | 18 | 2,523 | 35,700 | 1907 |
| | Madera..... | Madera Creek..... | Concrete weir..... | 125 | | 950 | | 2 1947 |
| | Duchesne Feeder Canal..... | Duchesne..... | Concrete weir, embankment wings..... | 200 | 6 | 3 220 | 4,000 | 1939 |
| | Broadhead..... | Broadhead Creek..... | Concrete overflow weir, embankment wing. | 22 | 4 | 68 | 708 | 1953 |
| | Duchesne..... | Duchesne, North Fork..... | Rockfill weir, concrete core wall..... | 600 | 17 | 480 | 10,020 | 1952 |
| | Murdock..... | Provo..... | Concrete weir, overflow, embankment wing. | 550 | 19 | 370 | 9,036 | 1950 |

TABLE 14.—*Annual appropriations and allotments from reclamation and other funds, fiscal years 1903-57*

| Fiscal year | Annual acts | | | Emergency relief funds allocated | Fort Peck continuing fund | Permanent appropriations | Total ¹ |
|-------------------|------------------|---------------|-------------------------|----------------------------------|---------------------------|--------------------------|--------------------|
| | Reclamation fund | General fund | Colorado River dam fund | | | | |
| 1903 | \$6,115,000 | | | | | | \$6,115,000 |
| 1904 | 16,890,000 | | | | | | 16,890,000 |
| 1905 | 4,750,000 | | | | | | 4,750,000 |
| 1906 | 12,015,161 | | | | | | 12,015,161 |
| 1907 | 2,209,000 | | | | | | 2,209,000 |
| 1907 ² | 41,979,161 | | | | | | 41,979,161 |
| 1907 | 34,313,233 | | | | | | 34,313,233 |
| 1908 | 7,918,366 | \$105 | | | | | 7,918,471 |
| 1909 | 9,791,400 | | | | | | 9,791,400 |
| 1910 | 9,368,000 | | | | | | 9,368,000 |
| 1911 | 27,366,790 | | | | | | 27,366,790 |
| 1912 | 6,459,000 | 391 | | | | | 6,459,391 |
| 1913 | 6,271,000 | | | | | | 6,271,000 |
| 1914 | 14,759,574 | | | | | | 14,759,574 |
| 1915 | 6,746,634 | | | | | | 6,746,634 |
| 1916 | 13,530,000 | | | | | | 13,530,000 |
| 1917 | 8,887,557 | 15,000 | | | | | 8,902,557 |
| 1918 | 8,227,000 | 331,423 | | | | | 8,558,423 |
| 1919 | 9,397,000 | 453,437 | | | | | 9,850,437 |
| 1920 | 7,300,000 | 560,074 | | | | | 7,860,074 |
| 1921 | 8,463,000 | 672,177 | | | | | 9,135,177 |
| 1922 | 20,266,000 | 346,871 | | | | | 20,612,871 |
| 1923 | 14,800,000 | 570,530 | | | | | 15,370,530 |
| 1924 | 13,800,000 | 334,867 | | | | | 14,134,867 |
| 1925 | 11,890,809 | | | | | | 11,890,809 |
| 1926 | 12,575,774 | 687,336 | | | | | 13,263,110 |
| 1927 | 7,436,320 | 75,000 | | | | | 7,511,320 |
| 1928 | 12,148,800 | 122,640 | | | | | 12,271,440 |
| 1929 | 14,328,400 | 115,000 | | | | | 14,443,400 |
| 1930 | 8,643,000 | 10,760,000 | | | | | 19,403,000 |
| 1931 | 9,482,000 | 100,000 | | | | | 9,582,000 |
| 1932 | 7,271,000 | 15,100,000 | | | | | 22,371,000 |
| 1933 | 2,817,288 | 23,050,513 | | | | | 25,867,801 |
| 1934 | 3,408,000 | 8,048,000 | | \$103,535,000 | | | 114,991,000 |
| 1935 | 1,176,750 | | | 34,076,000 | | | 35,252,750 |
| 1936 | 1,388,100 | 15,950,000 | | 25,438,000 | | | 42,776,100 |
| 1937 | 12,344,600 | 34,850,000 | \$350,000 | 4,873,000 | | | 42,671,600 |
| 1938 | 12,322,600 | 30,570,000 | 500,000 | 37,047,500 | | \$1,100,000 | 81,540,100 |
| 1939 | 10,940,600 | 32,995,000 | 500,000 | 2,502,488 | | 4,600,000 | 46,533,112 |
| 1940 | 13,875,600 | 64,215,000 | 575,000 | 28,347 | | 5,700,000 | 84,393,947 |
| 1941 | 10,000,600 | 62,971,335 | 768,000 | 124,300 | | 6,600,000 | 80,215,635 |
| 1942 | 8,111,000 | 92,862,031 | 1,000,000 | 19,961 | | 2,600,000 | 104,553,070 |
| 1943 | 3,607,960 | 86,645,460 | 1,379,250 | 1,131 | | 2,600,000 | 94,231,539 |
| 1944 | 4,514,475 | 35,702,067 | 1,443,100 | 72,709 | \$300,000 | 5,600,000 | 47,486,933 |
| 1945 | 7,649,800 | 18,601,448 | 2,200,000 | 22,332 | 100,000 | 13,100,000 | 41,628,916 |
| 1946 | 36,617,890 | 83,701,182 | 2,550,000 | | 200,000 | 4,856,302 | 127,925,374 |
| 1947 | 39,600,213 | 75,901,805 | 1,814,330 | 30,396 | | 4,600,000 | 121,885,952 |
| 1948 | 25,676,750 | 115,478,461 | 2,088,000 | | 308,000 | 5,280,000 | 148,831,211 |
| 1949 | 36,952,264 | 227,636,453 | 2,450,000 | | 355,000 | 4,440,000 | 271,833,717 |
| 1950 | 44,759,817 | 312,269,827 | 2,123,100 | | 403,229 | 7,641,440 | 367,197,413 |
| 1951 | 46,917,165 | 222,453,635 | 2,308,000 | | 358,605 | 5,694,729 | 277,732,134 |
| 1952 | 51,422,347 | 180,665,175 | 2,171,000 | | 634,900 | 6,665,088 | 241,558,510 |
| 1953 | 72,945,450 | 130,859,541 | 2,643,000 | | 695,796 | 7,743,965 | 214,887,752 |
| 1954 | 74,884,496 | 65,505,454 | 2,679,710 | | 633,802 | 4,610,748 | 148,314,210 |
| 1955 | 83,553,419 | 75,444,114 | 2,442,778 | | 735,900 | 5,953,500 | 168,129,711 |
| 1956 | 98,139,950 | 79,733,362 | 2,281,688 | | 716,626 | 4,403,500 | 185,275,126 |
| 1957 | 94,050,700 | 97,798,800 | 2,615,000 | | 741,712 | 5,711,617 | 200,917,829 |
| Total | 1,109,118,491 | 2,204,153,514 | 36,881,956 | 192,478,530 | 6,183,570 | 3109,500,889 | 3,658,316,950 |

¹ Credit.² Allotments made prior to Fallon, Nevada Conference on July 27, 1907, were canceled and summary allotments issued.³ Repayment of advances included: Boulder Canyon \$23,505,058, and All-American Canal System, \$3,252,000.

TABLE 15.—*The reclamation fund, fiscal years 1956-58, funds available for appropriation*

| Receipts and appropriations | Actual 1956 | Actual 1957 | Estimated 1958 |
|--|----------------|----------------|-------------------|
| Unappropriated balance brought forward (as of June 30)..... | \$92,751,703 | \$87,217,904 | \$98,960,399 |
| Accretions and collections: | | | |
| Bureau of Reclamation and other agencies, 100..... | 11,970,724 | 14,720,566 | 15,387,100 |
| Other agencies, 200..... | 35,583,729 | 39,615,072 | 46,198,300 |
| Power revenues, 300..... | 43,736,392 | 46,552,469 | 45,529,500 |
| Subtotal, accretions and collections..... | 91,290,845 | 100,888,107 | 107,114,900 |
| Plus expired and lapsed appropriations..... | 1,318,806 | 5,038,417 | ..... |
| Total available for appropriation..... | 185,361,354 | 193,144,428 | 206,075,299 |
| Less permanently authorized appropriations for: | | | |
| Refund of revenue collections..... | ..... | 125,000 | 125,000 |
| Farmers Irrigation District, North Platte project, Nebraska..... | 3,500 | 8,329 | 8,000 |
| Deduct annual appropriation or estimate for: | | | |
| General investigations..... | 4,421,812 | 4,970,000 | 5,182,000 |
| Construction and rehabilitation..... | 69,287,000 | 63,083,000 | 55,000,000 |
| Operation and maintenance..... | 20,171,138 | 22,055,700 | 22,740,000 |
| General administrative expenses..... | 3,760,000 | 3,942,000 | 4,164,000 |
| Emergency fund..... | 500,000 | ..... | ..... |
| Total annual appropriation or estimate..... | 98,139,950 | 94,050,700 | 87,086,000 |
| Total appropriations..... | 98,143,450 | 94,184,029 | 87,219,000 |
| Balance carried forward..... | 87,217,904 | 98,960,399 | 118,856,299 |

TABLE 16.—*Accretions to reclamation fund by States, fiscal year 1957*

| State | Sale of public land | | Proceeds from oil leasing act | | Total to June 30, 1957 |
|---|---------------------|---------------------|-------------------------------|---------------------|------------------------------|
| | Fiscal year 1957 | To June 30, 1957 | Fiscal year 1957 | To June 30, 1957 | |
| Alabama..... | | | \$2,849.43 | \$212,110.01 | \$212,110.01 |
| Arizona..... | \$196,287.57 | \$3,357,244.39 | 49,813.80 | 428,158.54 | 3,785,402.93 |
| Arkansas..... | | | 5,827.76 | 37,641.62 | 37,641.62 |
| California..... | 870,652.73 | 11,671,834.13 | 4,346,103.58 | 69,921,136.12 | 81,592,970.25 |
| Colorado..... | 246,317.37 | 11,477,985.51 | 5,959,944.75 | 35,596,999.34 | 47,074,984.85 |
| Florida..... | | | 419.08 | 2,589.04 | 2,589.04 |
| Idaho..... | 249,581.39 | 8,473,264.17 | 206,061.15 | 931,298.75 | 9,404,562.92 |
| Illinois..... | | | | 74.81 | 74.81 |
| Kansas..... | | 1,046,296.83 | 56,534.64 | 471,601.33 | 1,517,898.16 |
| Louisiana..... | | | 125,212.99 | 848,501.12 | 848,501.12 |
| Michigan..... | | | 1,816.22 | 29,726.87 | 29,726.87 |
| Mississippi..... | | | 4,297.41 | 21,055.02 | 21,055.02 |
| Montana..... | 182,763.66 | 16,473,418.32 | 1,630,958.74 | 12,718,915.99 | 29,192,334.31 |
| Nebraska..... | 2,710.95 | 2,216,018.17 | 12,619.64 | 72,134.62 | 2,288,152.79 |
| Nevada..... | 638,275.50 | 2,101,981.24 | 443,609.17 | 3,425,173.82 | 5,527,155.06 |
| New Mexico..... | 105,237.65 | 7,395,023.54 | 5,599,816.70 | 41,540,853.58 | 48,935,877.12 |
| North Dakota..... | 1,985.41 | 12,287,238.05 | 98,140.31 | 906,847.89 | 13,194,085.94 |
| Oklahoma..... | 1,536.00 | 5,970,928.02 | 30,135.56 | 257,536.71 | 6,228,464.73 |
| Oregon..... | 925,335.17 | 16,221,604.50 | 49,117.18 | 285,465.98 | 16,507,070.48 |
| South Dakota..... | 23,643.13 | 7,864,639.08 | 101,805.63 | 722,621.29 | 8,587,260.37 |
| Utah..... | 118,934.03 | 5,012,394.59 | 2,205,632.09 | 13,907,548.86 | 18,919,943.45 |
| Washington..... | 370,789.65 | 9,107,047.88 | 4,557.65 | 77,450.33 | 9,184,498.21 |
| Wyoming..... | 78,206.02 | 9,543,696.34 | 13,100,815.30 | 127,940,275.35 | 137,483,971.69 |
| Total..... | 4,012,256.23 | 130,220,614.76 | 34,036,088.78 | 310,355,716.99 | 440,576,331.75 |
| Other accretions | | | Fiscal year 1957 | | Totals to June 30, 1957 |
| Proceeds, Federal water power licenses..... | | | \$58,643.68 | | \$1,517,237.07 |
| Proceeds, potassium royalties and rentals..... | | | 1,507,586.07 | | 12,447,078.19 |
| Receipts from naval petroleum reserves, 1920-38, act of May 9, 1938..... |  |  | ..... |  | 29,778,300.23 |
| Proceeds from rights-of-way over withdrawn lands, act of July 19, 1919..... | | | 363.96 | | 12,372.00 |
| Miscellaneous items, other..... |  |  | ..... |  | 5.78 |
| Miscellaneous mineral leasing permits..... | | | 113.25 | | 113.25 |
| Total..... | | | 1,566,706.96 | | 43,755,106.52 |
| Grand total..... | | | 39,615,051.97 | | 484,331,438.27 |

TABLE 17.—*Cost of plant, property and equipment in each State, June 30, 1957*

| State and project | Completed works | | | | Construction in progress | Other physical property | Total |
|--|---------------------|-------------------|-----------------|------------------------------------|--------------------------|-------------------------|-----------------|
| | Multipurpose (1) | Irrigation (2) | Electric (3) | Municipal (M) and flood (F) (4) | | | |
| Total | \$1,040,309,851 | \$931,548,761 | \$637,987,572 | \$27,002,787 | \$304,250,195 | \$24,143,964 | \$2,965,243,130 |
| (Alaska): Eklutna | | | 32,338,492 | | 96,131 | | 32,434,623 |
| Arizona, subtotal | 90,361,850 | 59,978,043 | 108,463,647 | (F) 3,454,942 | 9,109,459 | 242,951 | 271,610,892 |
| Boulder Canyon: | | | | | | | |
| All-American Canal System (California) | 2,179,950 | | | | 57,710 | | 2,179,950 |
| Hoover Dam and powerplant (Nevada) | 44,486,803 | | 33,557,349 | | 85,632 | | 78,101,802 |
| Colorado River Front Work and Levee system (California-Nevada) | | | | (F) 3,454,942 | 7,196,535 | | 3,540,574 |
| Colorado River Storage: Glen Canyon Unit (Utah) | | 44,578,013 | | | 946,688 | 242,951 | 45,767,652 |
| Gila | | | 70,517,958 | | 579,694 | | 579,694 |
| Palo Verde (California) | 38,615,885 | 10,731,853 | 4,266,443 | | 243,200 | | 109,377,043 |
| Parker-Davis (California-Nevada) | 5,079,212 | 3,525,360 | 121,897 | | | | 20,077,508 |
| Salt River | | 1,142,817 | | | | | 3,647,257 |
| Yuma (California) | | | | | | | 1,142,817 |
| Yuma Auxiliary | | | | | | | |
| California, subtotal | 304,464,678 | 196,592,582 | 125,277,647 | (F) 9,131,647 | 82,577,465 | | 718,044,019 |
| Boulder Canyon: All-American Canal System (Arizona) | | | | (F) 3,329,787 | 65,403 | | 58,558,462 |
| Cachuma | 38,659,291 | 16,503,981 | | | 14,679,433 | | 43,147,124 |
| Central Valley | 232,300,099 | 168,217,570 | 106,045,350 | (F) 5,801,860 | 24,451,695 | | 531,014,714 |
| Colorado River Front Work and Levee System (Arizona-Nevada) | | | | | 5,162,497 | | 5,964,357 |
| Klamath (Oregon) | | 6,109,741 | | | 94,843 | | 6,204,584 |
| Oroville | | 2,588,870 | | | 59,291 | | 2,643,161 |
| Palo Verde (Arizona) | | | | | 2,827,691 | | 2,827,691 |
| Parker-Davis (Arizona-Nevada) | 5,037,597 | | 18,751,477 | | 12,703 | | 23,801,777 |
| Santa Maria | | | | | 4,097,011 | | 4,097,011 |
| Solano | | | | | 29,824,174 | | 29,824,174 |
| Loan Program-Distribution Systems | | | | | 30,439 | | 30,439 |
| Truckee Storage (Nevada) | | | | | 6,260,251 | | 6,260,251 |
| Ventura River | | | | | 12,034 | | 3,670,274 |
| Yuma (Arizona) | | 3,177,420 | 480,820 | | | | |

| | | | | | | | |
|---|-------------|-------------|------------|---------------|------------|---------|-------------|
| Colorado, subtotal..... | 53,451,065 | 104,331,162 | 42,315,039 | ..... | 869,265 | 152,251 | 201,118,782 |
| Colbran..... | | 80,399,394 | | | 220,529 | | 220,529 |
| Colorado-Big Thompson..... | 36,284,928 | | 41,387,246 | | 160,263 | | 158,231,831 |
| Colorado River Storage: Navajo Unit (New Mexico)..... | | | | | 265,912 | | 265,912 |
| Fruitgrowers Dam..... | | 200,309 | | | | | 200,309 |
| Grand Valley..... | | 5,781,101 | 213,669 | | 176,882 | | 6,171,652 |
| Mancoes..... | | 3,914,818 | | | | | 3,914,818 |
| Missouri River Basin..... | 13,296,854 | | 714,124 | | 44,083 | | 14,055,061 |
| Paonia..... | | 1,599,704 | | | | 152,251 | 1,751,955 |
| Pine River..... | | 3,469,877 | | | | | 3,469,877 |
| San Luis Valley..... | 3,869,283 | | | | 1,596 | | 3,870,879 |
| Uncompahgre..... | | 8,965,959 | | | | | 8,965,959 |
| Idaho, subtotal..... | 43,751,832 | 46,781,648 | 7,784,169 | (M) 1,020,096 | 62,719,868 | 27,978 | 162,085,591 |
| Avondale..... | | 244,424 | | | | | 244,424 |
| Boise (Oregon)..... | 33,130,536 | 25,924,169 | 5,030,810 | | 737,037 | | 64,822,552 |
| Dalton Gardens..... | | 258,660 | | | | | 258,660 |
| King Hill..... | | 1,877,732 | | | | | 1,877,732 |
| Lewiston Orchards..... | 426,999 | 1,037,302 | | 1,020,096 | | | 2,484,397 |
| Michaud Flats..... | | 26,899 | | | 1,990,233 | | 2,017,132 |
| Minidoka (Wyoming)..... | 8,675,493 | 16,028,102 | 2,753,359 | | 3,380,857 | 27,978 | 30,865,789 |
| Owyhee (Oregon)..... | | 902,000 | | | 66,112 | | 968,112 |
| Palisades (Wyoming)..... | 1,518,804 | | | | 56,445,168 | | 57,963,972 |
| Preston Bench..... | | | | | | | |
| Rathdrum Prairie..... | | | | | | | |
| Post Falls..... | | 363,951 | | | | | 363,951 |
| Hayden Lake, Nevada..... | | 118,409 | | | | | 118,409 |
| Iowa: Missouri River Basin transmission lines..... | | | 1,150,660 | | 100,461 | | 100,461 |
| Kansas, subtotal..... | 39,066,552 | 2,773,980 | | | 1,411,558 | | 2,562,218 |
| Garden City..... | | 334,475 | | | | | 334,475 |
| Missouri River Basin..... | 39,066,552 | 2,439,505 | | | 16,260,977 | | 57,767,034 |
| Minnesota: Missouri River Basin transmission lines..... | | | 183,001 | | 3,592,984 | | 3,775,985 |
| Montana, subtotal..... | 120,438,992 | 48,586,249 | 45,086,899 | | 7,166,344 | 236,560 | 221,515,044 |
| Bitter Root..... | | 1,052,873 | | | 36,554 | | 1,089,427 |
| Buffalo Rapids..... | | 4,696,541 | | | 228,427 | | 4,924,968 |
| Fort Peck (North Dakota)..... | | | 10,573,151 | | 52,993 | | 10,626,144 |
| Frenchtown..... | | 279,321 | | | | | 279,321 |
| Hungry Horse..... | 79,455,164 | | 22,140,294 | | 50,070 | | 101,645,528 |
| Huntley..... | | 1,745,066 | | | 30,109 | | 1,775,175 |
| Intake..... | | 94,213 | | | | | 94,213 |
| Lower Yellowstone (North Dakota)..... | | 3,031,553 | | | | | 3,031,553 |
| Milk River..... | | 9,343,132 | | | 269,043 | | 9,612,175 |
| Missoula Valley..... | | 278,320 | | | | | 278,320 |
| Missouri River Basin..... | 39,422,077 | 1,990,609 | 8,968,435 | | 6,125,908 | 236,560 | 56,743,589 |

TABLE 17.—*Cost of plant, property and equipment in each State, June 30, 1957—Continued*

| State and project | Completed works | | | | | Construction in progress | Other physical property | Total |
|--|---------------------|-------------------|-----------------|---------------------------------------|-----------|--------------------------|-------------------------|-------|
| | Multipurpose (1) | Irrigation (2) | Electric (3) | Municipal (M) and flood (F) (4) | (5) | | | |
| Montana, subtotal—Continued | | | | | | | | |
| Shoshone (Wyoming) | \$1,561,751 | \$16,075,988 | \$3,405,019 | | \$294,769 | \$21,337,527 | | |
| Sun River | | 9,998,833 | | | 78,471 | 10,077,304 | | |
| Nebraska, subtotal | 37,102,112 | 41,711,852 | 7,625,980 | | 8,602,038 | 95,041,982 | | |
| Mirage Flats | | 3,061,026 | | | | 3,061,026 | | |
| Missouri River Basin | 37,102,112 | 28,825,696 | 7,382,412 | | 8,602,038 | 81,912,258 | | |
| North Platte (Wyoming) | | 9,824,830 | 243,568 | | | 10,068,098 | | |
| Nevada, subtotal | 53,354,380 | 9,822,197 | 36,717,607 | (F)\$102,123 | 311,649 | \$107,777,258 | \$7,469,302 | |
| Boulder Canyon: | | | | | | | | |
| Hoover Dam and powerplant (Arizona) | 49,911,214 | | 32,122,062 | | 150,907 | 83,894,986 | 1,710,803 | |
| Boulder City Municipal | | | | (F)102,123 | | 5,723,273 | 5,723,273 | |
| Colorado River front work and levee system (California-Nevada) | | 1,214,321 | | | 85,633 | 187,756 | | |
| Humboldt | | 7,515,453 | 344,343 | | 69,775 | 1,284,096 | 35,226 | |
| Newlands | 3,443,166 | 1,092,423 | 4,251,202 | | 5,334 | 7,895,022 | | |
| Parker-Davis (Arizona-California) | | | | | | 7,693,702 | | |
| Truckee Storage (California) | | | | | | 1,092,423 | | |
| New Mexico, subtotal | 16,420,004 | 38,430,275 | 8,117,143 | (F)272,926 | 5,600,016 | 68,840,364 | | |
| Carlsbad | 3,179,992 | 2,059,600 | | | | 5,239,592 | | |
| Colorado River Storage: | | | | | | | | |
| Navajo Unit (Colorado) | | | | | | | | |
| Fort Sumner | | 2,371,986 | | | | 2,371,986 | | |
| Hondo | | 339,377 | | | | 339,377 | | |
| Middle Rio Grande | 3,705,925 | 11,006,029 | | | 5,415,949 | 20,218,503 | | |
| Rio Grande (Texas) | 8,135,637 | 6,004,035 | 8,117,143 | (F)272,926 | 172,067 | 22,701,828 | | |
| Tucuman | | 15,474,082 | | | | 15,474,082 | | |
| Vermejo | 1,398,450 | 1,084,546 | | | 12,000 | 2,494,996 | | |
| North Dakota, subtotal | 8,327,991 | 3,426,562 | 28,812,475 | | 1,427,040 | 41,994,068 | | |
| Buford-Trenton | | 1,089,696 | | | 565 | 1,090,261 | | |
| Buford-Trenton, old | | 223,423 | | | | 223,423 | | |
| Fort Peck (Montana) | | | 1,552,945 | | 655 | 1,553,600 | | |

TABLE 17.—*Cost of plant, property and equipment in each State, June 30, 1957—Continued*

| State and project | Completed works | | | | Construction in progress | Other physical property | Total |
|--|---------------------|-------------------|-----------------|------------------------------------|--------------------------|-------------------------|-------------|
| | Multipurpose (1) | Irrigation (2) | Electric (3) | Municipal (M) and flood (F) (4) | | | |
| Utah, subtotal—Continued | | | | | | | |
| Scofield | \$943,837 | | | | | | \$943,837 |
| Strawberry Valley | | \$3,332,530 | \$91,804 | | | \$61,085 | 3,485,419 |
| Weber Basin | | 2,724,487 | | | \$26,587,964 | | 26,587,964 |
| Weber River | | | | | | | 2,724,487 |
| Washington, subtotal | 157,240,699 | 249,260,855 | 110,746,102 | | 38,268,371 | 11,877,791 | 567,393,818 |
| Chief Joseph Dam | | | | | 1,134,881 | | 1,134,881 |
| Columbia Basin | 151,479,303 | 205,450,911 | 107,623,563 | | 28,420,137 | 11,877,791 | 504,831,705 |
| Okanogan | 1,498,251 | | | | 7,319 | | 1,505,570 |
| Yakima | 5,761,396 | 42,311,693 | 3,122,539 | | 8,706,034 | | 59,901,662 |
| Wyoming, subtotal | 44,657,637 | 43,485,652 | 47,308,157 | | 24,156,442 | 996,450 | 160,604,338 |
| Colorado River Storage: Flaming Gorge Unit (Utah) | | | | | | | |
| Edon | | 4,316,812 | | | 2,049,853 | | 6,366,665 |
| Kendrick | | 9,969,250 | | | 34,070 | | 30,478,822 |
| Minidoka (Idaho) | 5,166,889 | 2,209,904 | 15,308,613 | | | | 2,209,904 |
| Missouri River Basin | 32,750,585 | 610,751 | 30,175,899 | | 20,871,808 | 11,582 | 84,420,625 |
| North Platte (Nebraska) | 3,321,120 | 9,275,237 | 1,343,579 | | 176,362 | | 14,116,298 |
| Palisades (Idaho) | 448,574 | | | | 376,396 | | 824,970 |
| Riverton | 2,970,469 | 17,087,298 | 480,066 | | 647,953 | 984,868 | 22,170,654 |
| Shoshone (Montana) | | 16,400 | | | | | 16,400 |
| Non-project property | | | | | 49,351 | 2,992,634 | 3,041,985 |

NOTES.—Name of State in which balance of project is located is indicated by parentheses (except Missouri River Basin, located in 10 States). Irrigation plant is listed at gross construction cost prior to deduction of chargeoffs authorized by Congress.

Municipal and industrial water plant (M) totals \$14,041,149 and flood control plan (F) totals \$12,961,638.

¹ Construction costs classified as funded operation and maintenance charges.

The 11th edition of the Bureau's Hydraulic and Excavation Tables comprising computational data for use in design and construction of hydraulic structures was published during the year. Technical records on the design and construction of Anderson Ranch Dam and powerplant, Boysen Dam and powerplant, and volume I of the Colorado-Big Thompson project, covering planning, legislation, and general description of the project were also published. The Materials Laboratory Procedures Manual was issued.

In response to 7,575 requests for the Bureau's publications and informational materials received from individuals in this country and in foreign countries, 21,000 copies of technical publications and informational pamphlets were sold or distributed. Sales of Bureau publications totaled \$24,000, more than one-half of this total being made to foreign countries. Sales of publications sold for the Superintendent of Documents totaled \$6,200.

PROJECT DEVELOPMENT

The project development program involves preparation of comprehensive plans for development of river basin resources and the investigation and planning of potential projects for the conservation and utilization of the water resources of the West. It also includes detailed preconstruction studies on newly authorized projects.

Comprehensive Basin Surveys

Comprehensive surveys were undertaken in 12 basins throughout the West. Of these studies, an interim evaluation report was prepared on the Umpqua River Basin in Oregon, and a report on the Upper American River basin in California approached completion. In addition, comprehensive studies were active in 14 subbasins of the Missouri River Basin project, with reports completed on the Kansas River Basin, the North Platte River Basin and the Powder Division.

Investigations continued on the permanently authorized investigations program of the Bureau in Alaska.

Project Planning Reports

By the end of the fiscal year, feasibility reports had been submitted to Congress on the San Luis Unit of the Central Valley project in California, the Burns Creek Dam, Reservoir and powerplant of the Palisades project in Idaho, the Mercedes Division of the Lower Rio Grande rehabilitation project in Texas, and on the San Angelo project in Texas.

Reports submitted to the Bureau of the Budget include those on the Greater Wenatchee Division of the Chief Joseph Dam project in Washington and the Norman project in Oklahoma.

Reports being reviewed by States and Federal agencies prior to submission to the Bureau of the Budget include those on the Spokane Valley project in Washington, the Harlingen, El Jardin and La Feria Divisions of the Lower Rio Grande rehabilitation project in Texas, the Rio Grande and Weminuche Pass Divisions of the San Luis Valley project in Colorado, and the Garrison diversion unit of the Missouri River Basin project in North and South Dakota.

The Harlingen Division of the Lower Rio Grande rehabilitation project was subsequently considered by the local interests for construction under the Small Reclamation Projects Act of 1956.

Definite Plans Reports

Definite plans reports were completed and approved on the Webster unit of the Missouri River Basin project in Kansas, the Hayden Lake unit of the Rathdrum Prairie project in Idaho, the Foster Creek Division of the Chief Joseph Dam project in Washington, the Juniper Division of the Wapinitia project in Oregon, Little Wood River project in Idaho, East Bench unit of the Missouri River Basin project in Montana, and the Collbran project in Colorado.

Loan Program

The Small Reclamation Projects Act of 1956 was approved by the President on August 6, 1956. The act contained provisions objectionable to the President which prevented the approval of projects for loans until amendments were made. The necessary amendments were passed by the Congress and were approved by the President on June 5, 1957. This act permits loans of up to \$5 million for the development of irrigation projects which may cost up to \$10 million. It also permits nonreimbursable grants for certain public benefits, up to \$5 million for both the loan and the grant.

Although projects could not be approved until the act was amended, the Bureau worked with various applicants in preparing their material. Two applications were almost ready for Secretarial consideration by the end of the fiscal year and several others were well advanced.

Public Law 130, 83d Congress authorized loans for the construction of irrigation distribution systems on authorized projects in lieu of construction by the Bureau. One loan for \$12,302,000 to the Solano Irrigation District in California was approved.

River Compacts

The Bear River Compact, previously ratified by Idaho and Utah, was ratified by the State legislature of Wyoming and submitted to the Congress for approval.

The Klamath River Compact was ratified by the State legislatures of California and Oregon and submitted to the Congress for approval.

The Columbia River Compact, previously approved by the Columbia Interstate Compact Commission and submitted to several State legislatures for approval and ratified by the States of Idaho, Nevada, and Utah was subsequently modified on August 6, 1956, and resubmitted to the State legislatures of Washington, Oregon, Idaho, Montana, Wyoming, Utah, and Nevada for ratification.

Bills were introduced in the Congress requesting consent to negotiate compacts between the ten Missouri River Basin States regarding the Missouri River and between Wyoming, Montana, and North Dakota, regarding the Little Missouri River.

The consent of the Congress to negotiate compacts had been previously obtained for compacts between Arkansas and Oklahoma and between Kansas and Oklahoma regarding the Arkansas River; between Arkansas, Louisiana, Oklahoma and Texas regarding the Red River; between California and Nevada regarding the Truckee, Carson, and Walker Rivers, and Lake Tahoe; and between Wyoming and Nebraska regarding the Niobrara River. Preparation of those compacts are awaiting compilation of necessary hydrologic data which is in progress.

Hydrology

General hydrologic problems which confront investigators on many proposed Reclamation projects were under study this past fiscal year. These studies covered the fields of storm and flood hydrology, sedimentation and water conservation and utilization.

Procedures for the preparation of tailwater curves, which have been under development for the past several years, were formulated in a technical manual.

Investigation of evaporation along several lines has continued in collaboration with the Geological Survey. High altitude studies at Granby Reservoir and Pikes Peak, both in Colorado, were continued to assist in evaluating reservoir evaporation in the higher and more remote areas of the Western States.

Studies were started in cooperation with the Soil Conservation Service and the Agriculture Research Service, to develop methods

of procedure for the determination of the effects of watershed treatment measures upon downstream runoff.

International Streams Investigations

The Souris-Red Rivers Engineering Board through interested Federal agencies continued the systematic collection and study of hydrologic data and related flood control, and irrigation investigations in the Souris and Red Rivers. The Board also assisted the Commission on engineering matters in the consideration of an apportionment of the waters of the Souris River between the United States and Canada under the Souris-Red Rivers reference of January 12, 1948. During the fiscal year the Waterton-Belly Rivers Engineering Board was inactive in connection with the Waterton-Belly Rivers reference of the same date.

PROGRAM COORDINATION AND FINANCE

Construction schedules and the estimates supporting these schedules were expanded to include the cost of appurtenant activities which, while not technically construction costs, are necessary in the process of bringing a project to condition for operation and maintenance. This refinement resulted in a more realistic estimate of the total and annual funds required for construction projects.

Coordination of apportionments with contract award schedules was refined so that the amounts established for obligation by quarters more closely parallel requirements of the construction projects.

In finance and accounting operations a number of new procedures in cost accounting and reporting were instituted; a centralized finance organization was established for the Upper Colorado River Storage project; an accountant's trainee program was inaugurated; and a feasibility study of the use of electronic equipment in accounting operations was in process at the end of the fiscal year.

Statistical time series references designated as official source for frequently required administrative and management data on the Bureau's activities were maintained current. These covered (a) current and projected program operations presented in the Bureau's Monthly Report on Progress and Status of Funds; Forecasts on Utilization of Funds, Bureau Progress, Monthly Federal Civilian and other interim and annual employment reports; (b) operating financial and related physical data presented in the Bureau's Statisti-

cal Appendix to the Secretary's Annual Report; and (c) pertinent interim reports and chart exhibits. In addition, manuscripts were prepared for new editions of the Bureau's publications titled "Project Feasibilities and Authorizations"; "Appropriation Acts and Allotments" (new supplement) and "Repayment Histories and Payout Schedules" each of which are regularly brought up-to-date every 5 years, the last editions being those of 1952.

Budget

Appropriations for all purposes made available to the Bureau of Reclamation for fiscal year 1957 totaled \$193,864,500. This amount included \$12,750,000 in supplemental funds appropriated primarily for loans to irrigation districts for the construction of distribution systems on Bureau projects. Permanent appropriations or revolving funds are not included in this amount. The appropriation for 1957 totaled \$13,709,500 more than was appropriated for 1956.

With an unobligated balance of \$31.9 million carried over from fiscal year 1956 for construction and investigations, plus one-year appropriations for O. & M. and G. A. E. funds advanced by water users, trust funds and a continuing fund for emergency expenses, Fort Peck project, the total amount available to Reclamation was \$231.5 million. Of this amount there remained unobligated at the close of 1957 construction and investigation funds in the amount of \$31.9 million which are available for fiscal year 1958.

Obligations for 1957 totaled \$197.0 million or 92 percent of the obligations programed as compared to 83 percent of the program accomplished in 1956.

The appropriation act for 1957, as in recent years, prohibited initiating construction on transmission facilities in areas covered by power wheeling contracts unless the wheeling agencies were unable or unwilling to provide the service. Also the limitation upon the amount of money that may be expended for work by Government forces (force account work) was repeated in the 1957 act. This limitation provided that not to exceed 12 percent of the allotment for any one project or unit of the Missouri River Basin project, with a maximum of \$225,000 for any such project or unit, was to be so used.

The amounts appropriated by activity for fiscal year 1957, together with the amounts to be derived from the special and general funds, follow:

TABLE 18.—*Condensed statement of appropriations, fiscal year 1957, exclusive of trust funds and permanent appropriations*

| | |
|--------------------------------------|----------------|
| General investigations..... | \$5, 680, 000 |
| Reclamation fund..... | \$4, 970, 000 |
| Colorado River development fund..... | 500, 000 |
| General fund..... | 210, 000 |
| Construction and rehabilitation..... | 143, 975, 500 |
| Reclamation fund..... | \$63, 083, 000 |
| General fund..... | 80, 892, 500 |
| Upper Colorado River Basin..... | 13, 000, 000 |
| General fund..... | \$13, 000, 000 |
| Operation and maintenance..... | 27, 267, 000 |
| Reclamation fund..... | \$22, 055, 700 |
| Colorado River Dam fund..... | 2, 115, 000 |
| General fund..... | 3, 096, 300 |
| General administrative expenses..... | 3, 942, 000 |
| Reclamation fund..... | \$3, 942, 000 |
| Grand total..... | 193, 864, 500 |
| Reclamation fund..... | \$94, 050, 700 |
| Colorado Dam fund..... | 2, 115, 000 |
| Colorado River development fund..... | 500, 000 |
| General fund..... | 97, 198, 800 |

ADMINISTRATION

Contracts and Property Management

Total procurement by purchase orders and supply and service contracts for the 1957 fiscal year approximated \$21,660,000, an increase in dollar value of about \$4,280,000, and 25 percent over the preceding fiscal year's business. Orders placed with small-business firms increased about 32 percent from last year, some \$2,300,000, or a total in 1957 of \$9,122,000. The number of procurement actions increased from 79,513 to 90,962, for the same period, or about 14 percent.

Real property with an acquisition cost of \$2,665,066 was disposed of, eliminating cost of management and operation and maintenance of such property.

Personal property with an original cost of \$705,566 was declared surplus. Of this amount, \$508,700 worth was ultimately sold with proceeds amounting to \$147,706 or approximately 29 percent of the original cost. In addition, personal property with an original cost of \$146,668 was donated for educational or public health purposes. Personal property acquired from other agencies included property with an original cost of \$217,889, for which reimbursement of \$87,892 was required. Property with an original cost of \$374,694, for which reimbursement was not required, was acquired.

Organization and Methods

New operating guides and procedures were prepared and issued through the Reclamation instruction system to cover the development of cost estimates for construction and irrigation, the preparation of the annual crop census report on irrigation projects, the operation and maintenance of irrigation systems, the custody, maintenance, and disposition of Bureau property other than real estate, and administrative subjects of general interest.

General Services

The incentive awards activity increased by about 20 percent, a total of 1,103 suggestions for the improvement of Bureau activities and procedures being received during the year. Of these, approximately 49 percent were adopted and the employees who proposed the improvements were awarded \$20,685. These suggestions resulted in an estimated gross annual saving of \$1,202,965. Over 200 employees were granted cash awards in recognition of superior performance. A Bureau employee participated in a \$12,000 award which was the highest cash award that had been granted in a civilian Federal agency.

During the fiscal year the Bureau received and created 11,640 cubic feet of records; disposed of 9,026 cubic feet; transferred to Federal records centers for custody and servicing 1,704 cubic feet; and, transferred to other Government agencies, water users' organizations, etc., 531 cubic feet. These resulted in an increase in volume of records held by all Bureau offices from 112,000 to 112,300 cubic feet. This increase was caused primarily by personnel turnovers in a number of field offices which created perceptible slowdowns in disposals and transfers pending training of new qualified personnel. Approximate dollar savings in space and equipment costs as a result of destruction and transfers to low-cost space amounts to \$95,040.00.

In response to 7,575 requests for the Bureau's publications and information material received from individuals in this country and in foreign countries, more than 21,000 copies of technical publications and informational pamphlets were sold at Denver or distributed from there. Sales of Bureau publications at Denver totaled \$24,000, approximately one-half of this total being made to foreign countries. Sales of publications sold by the Bureau as agent for the Superintendent of Documents totaled \$6,200.

In response to 543 requests 8,941 copies of Bureau publications were distributed. Of these requests, 109 were of congressional origin for 1,538 publications and 138 were from agencies of the executive branch of the Federal Government for 929 copies.

Two thousand and ninety-six prints were provided for reproduction in Bureau publications, non-Government textbooks and encyclopedias, various agricultural and engineering magazines and newspapers, and to supplement exhibits and lectures. Requests by mail and in person for visual material were also received from congressional offices and from agencies of the executive branch of the Federal Government.

Seven hundred and twenty-six films were distributed to television stations, agricultural and engineering institutions, water users' associations, organizations of farmers, and to conventions in the United States and abroad.

Comptroller

Ninety-two audit assignments were completed during the year. They comprised 84 comprehensive project audits; 2 audits of water users' organizations, performed at their request; 3 special audits; and 3 miscellaneous assignments which resulted in informal letter reports.

At the request of The Alaska Railroad a member of the Comptroller's staff was temporarily assigned to that agency to assist in the solution of certain technical problems.

Personnel

In order to overcome manpower shortages, increased attention was given to ways in which the skills and abilities of employees could be more effectively utilized. A qualifications data roster was established facilitating the matching of employees' skills and position vacancies on a Bureauwide basis covering all employees in grades GS-9 through GS-14.

A program for the advance scheduling and placement of surplus employees was initiated. Placements for employees on projects nearing completion are scheduled as much as six months in advance; this provides employees with an optimum degree of employment stability.

Aggressive recruitment action was taken to meet continuing manpower shortages in engineering and other categories. Recruitment for engineers was made on a nationwide basis with visits to 114 accredited engineering colleges and universities. More than 150 engineering students and 125 new graduate engineers were brought into Bureau training programs during the year.

Programs for the recruitment and training of beginning accountants and administrative employees were developed and implemented to provide a modest but continuing intake of employees in these categories in support of the engineering organization. There was continued emphasis on other employee development activities.

Extensive position classification review was performed throughout the Bureau and duty realignments accomplished to conform positions to program and organization changes. Bureau personnel technicians participated in Interdepartmental Classification and Wage Conferences held in Denver, Portland, and Washington.

Wage board hearings and negotiations were conducted to adjust pay rates to conform to prevailing practices. Annual negotiations also were held with unions and trades councils in areas under collective bargaining.

Bureau employment increased to 10,506 full-time employees at the end of the 1957 fiscal year from 10,018 at end of 1956.

DIVISION OF FOREIGN ACTIVITIES

Many requests were received from various public and private agencies for assistance to foreign governments in the development of their water resources. However, due to the increased demands of our domestic program and the acute shortage of experienced engineers, Bureau of Reclamation participation in these various technical assistance programs was largely limited to the training of foreign nationals and the performance of specialized laboratory studies and design work in the office of the Assistant Commissioner and Chief Engineer in Denver.

During the year, 141 foreign engineers and other technical people from 21 countries spent periods of 6 months or longer in on-the-job training assignments with the Bureau of Reclamation, and 125 participants from 22 countries spent shorter periods of official observation with our various offices. In addition, there were over 100 foreign accredited visitors and several hundred tourists, students and other foreign nationals who stopped at various Bureau of Reclamation installations.

Under Special Project Agreements with International Cooperative Administration, whereby the Bureau of Reclamation assumes the technical responsibility for certain projects, there were 15 people on overseas assignments during the year in Lebanon, Formosa, and Pakistan. In addition there were 7 Reclamation engineers on extended details to ICA and 3 on short term details. Five Bureau people were on extended assignments to Australia under a Public Law 402 agreement.

The services of the design offices and laboratories in Denver were much in demand. Work was accomplished on the Snowy Mountains Hydro-Electric project, Australia; Wu-Sheh and Shimen Dams, Taiwan; Chao Phya and Yan Hee projects, Thailand; several river basins in Lebanon; and various projects of the Central Water and

Power Commission, India. This work included design, design review, laboratory studies, and the review of reports.

LEGAL

The fiscal year 1957 which included the last 6 weeks of the 84th Congress and the first 6 months of the 85th, was a productive one legislatively.

The three outstanding long-range enactments of the period were Public Law 984, 84th Congress, which, with the amendment embodied in Public Law 47, 85th Congress, sets the groundwork for the program of loans and grants for small reclamation projects toward which Western delegations have been working for many years; Public Law 643, 84th Congress, which should serve to remove objections to the so-called 9 (e) or utility-type contract which is widely used on the Central Valley and Missouri River Basin projects; and Public Law 690, 84th Congress, which clarifies the answers to problems arising out of the acquisition of excess lands by descent, devise, foreclosure, or other process of law.

In addition to these, other principal achievements during the fiscal year were enactment of bills providing authority to construct the Washoe, Crooked River, and Little Wood River projects (Public Law 858, Public Law 992, and Public Law 993, 84th Cong., respectively); reauthorizing the Farwell unit of the Missouri River Basin project (Public Law 952, 84th Cong.); providing for execution of a repayment contract with the Tule Lake Irrigation District, Klamath project (Public Law 877, 84th Cong.); transferring administration of the San Diego aqueduct from the Navy Department to the Interior Department (Public Law 38, 85th Cong.); and providing authority for Government purchase of equipment to be turned over to water users' organizations when they take over the care, operation, and maintenance of projects (Public Law 924, 84th Cong.).

Litigation

Major litigation problems involving water and power problems during the year were:

1. *Rank v. Krug, et al.*—The history of this case appears in the 1956 Annual Report of the Secretary, page 62. An amended and corrected judgment was filed June 21, 1957.

2. *In the matter of the California Oregon Power Co.* (FPC Project No. 2082; FPC Docket E-6390). A history of these proceedings appear in the 1956 Annual Report of the Secretary, pages 62-63. In an opinion dated October 25, 1956, the United States Court of

Appeals for the District of Columbia dismissed, for lack of a justifiable controversy, the petitions for review by COPCO of the orders of the Federal Power Commission insofar as they are based on findings that COPCO's existing projects and its proposed Big Bend No. 2 project would utilize surplus water from the Link River Dam on the Klamath project.

3. *Citizens Utilities Co. v. United States* and *California-Pacific Utilities Co. v. United States*, United States Court of Claims (Nos. 364-55, 381-55). The first named action was filed in the Court of Claims September 20, 1955, for damages totaling \$12,216,775 alleged to have been sustained as a result of the wrongful and unlawful failure and refusal of the United States to renew its contract for purchase of a portion of the Metropolitan Water District's unused Hoover Dam energy.

On October 12, 1955, California-Pacific Utilities Co., holder of a similar energy contract which also by express terms of limitation terminated December 31, 1954, also filed suit for damages totaling \$4,579,807 alleged to have been sustained by reason of the wrongful and unlawful failure and refusal of the United States to renew its said contract. Defendant filed answer in each case, and its motion that the two cases be consolidated was granted by the court on December 29, 1955. Thereupon defendant filed its motion for leave to file motion for notice to third parties, namely, the city of Los Angeles and its Department of Water and Power, Southern California Edison Co., California Electric Power Co. and the Metropolitan Water District of Southern California.

Defendant's motions were granted and the notices to said parties were issued by the clerk of the court on February 1, 1956. Plaintiffs filed motions for summary judgment and briefs in support thereof and a similar motion and brief were filed by defendant. On March 6, 1957, the Court of Claims rendered a unanimous opinion in favor of the plaintiffs. Requests for rehearing were denied on June 5, 1957.

4. *State of Arizona, Plaintiff v. State of California et al.*, No. 10, Original, Supreme Court of the United States. In this action the State of Arizona is seeking a determination of its rights in and to the use of the waters of the Colorado River, as against such rights claimed by the defendants, under the Colorado River Compact, the Boulder Canyon Project Act, and the California Limitation Act. Trial of the case before Special Master Simon H. Rifkind continued at intervals throughout the year. Three sessions were held in June 1956; in February 1957; and in May 1957.

5. *Ronald Miller et al. v. Robert W. Jennings, et al.*, United States Court of Appeals for the 5th Circuit (No. 16135). This action was brought in the District Court of Hudspeth County, Texas, by Hud-

speth County Conservation and Reclamation District No. 1 and five individual water users claiming to represent a class. The action was removed to the United States District Court for the Western District of Texas.

Plaintiffs sought declaratory and injunctive relief against the Regional Director of the Bureau of Reclamation and others, claiming rights to certain water in the upper Rio Grande which were asserted to have been violated or to be endangered by conduct of the defendants. The court below dismissed the complaint on the ground that the United States had not consented to be sued. This suit was basically a second attempt to obtain relief previously sought in the case of *Hudspeth County Conservation and Reclamation District No. 1 v. Robbins* (5 Cir. 1954, 213 Fed. 2d 425) which was directed by the Circuit Court to be dismissed for want of jurisdiction against the United States.

In the instant case, the United States was a named defendant and the assertion was made that the United States had waived immunity in the act of July 10, 1952 (66 Stat. 560; 43 U. S. C. sec. 666), concerning the adjudication and administration of rights to the use of water of a river system or other source. The court held that the section was not applicable as no adjudication of rights with respect to the upper Rio Grande could be made where all persons having rights were not before the court. For the requirement that all such persons must be represented the court cited *People of the State of California v. United States*, 9th Circuit 1956, 235 Fed. 2d 647; *Wilson v. Reeves County Water Improvement District No. 1*, Tex. Civ. App., 256 S. W. 346; and *Martinez v. Maverick County Water Control and Improvement District No. 1*, 5th Circuit 1955, 219 Fed. 2d 666.

6. *Arthur E. Graham, also known as Bud E. Graham v. United States*. In this action in the United States District Court, District of Arizona, plaintiff seeks to recover \$35,100 damages to his property located downstream from Parker Dam, alleged to have resulted from defendant's negligence in connection with dredging operations on the Colorado River conducted by the Bureau of Reclamation. The action is a sequel to a damage claim for like amount filed by Graham's attorneys March 17, 1955, and rejected by the Regional Solicitor, Los Angeles, on June 24, 1955, without consideration of its merits, pursuant to the Federal Tort Claims Act (28 U. S. C., secs. 2401, 2671-2680). On February 19, 1957, plaintiff's attorneys presented a proposal for possible settlement of the action. After discussions with the United States Attorney and the Regional Solicitor, the Regional Director on April 11 rejected the offer.

7. *George H. Pashley, et ux. v. United States*. The action was filed in the Court of Claims in March of 1955 for \$200,000 in damages for

the alleged flooding of a sodium sulphate deposit below the O'Sullivan Dam as a result of the construction and operation of that dam by the Bureau of Reclamation on the Columbia Basin project. On December 5, 1956, the Commissioner filed a report stating that, in the event the court finds that the plaintiffs are entitled to recover, recovery should not exceed \$2,500.

8. *United States v. C. F. Williamson et al.*; *United States v. Sylvester E. Flanagan, et al.*; *United States v. Harold Schwab*; *United States v. Western Cold Storage, Inc., et al.*; *United States v. Stephen E. Chaffee, et al.*; and *United States v. Clayton W. Michel, et al.* These cases were filed in the United States District Court, Eastern District of Washington in May 1956, charging the defendants with conspiracy in connection with alleged violations of the Columbia Basin Project Act. The defendants in the first three cases pleaded guilty and were given fines or deferred sentences. The indictment in the fourth case was dismissed. The other two cases are awaiting trial.

9. *Charles Washburn v. United States* and *James Washburn v. United States*. These cases were filed in the United States District Court, Eastern District of Washington, Northern Division, Spokane, Wash., in November 1956, for \$10,000 in damages each for the alleged flooding of an access road through operation of Grand Coulee Dam for flood control purposes, and preventing the plaintiffs from reaching land they owned on an island in the Columbia River and farming the same during 1956. Issues have been joined in both cases, and they are awaiting their turns on the trial calendar.

10. *United States v. Basin Homes, Inc., et al.* The case was filed in the United States District Court, Eastern District of Washington, Northern Division, Spokane, Wash., in June 1957, for the purpose of obtaining a mandatory injunction requiring the defendants to remove the houses and other obstructions they had constructed on a Columbia Basin project wasteway. The issues in this case have not yet been joined.

11. *J. G. Shotwell v. United States, et al.* The case was filed in the United States District Court, Eastern District of Washington, Northern Division, Spokane, Wash., in July 1953, to restrain the defendants from taking and using aggregate produced from and stockpiled on Government-owned land by the plaintiff and for damages in the sum of \$13,950 for conversion of aggregate. The United States filed a counterclaim in the sum of \$2,000 for aggregate from its land which had been produced and sold by the plaintiff. The temporary restraining order and some of the defendants were subsequently dismissed.

Contract Litigation

Handling of contract litigation is an important function cooperatively performed by the Bureau of Reclamation and the Solicitor's Office. The defense of such cases in the Court of Claims and in the United States district courts, is the primary responsibility of the Department of Justice. However, the Solicitor's Office and administrative personnel of the Department work closely with Department of Justice attorneys in the defense of such cases. Contract claims exceeding \$10,000 can be prosecuted by the claimant only in the United States Court of Claims. Claims involving less than \$10,000 can be prosecuted either in the local United States district court or in the Court of Claims at the option of the claimant. The bulk of contract litigation both in number of cases and amount involved is in the Court of Claims.

Significant actions or developments in connection with individual contract cases during fiscal year 1957 are as follows:

1. *A. S. Schulman Electric Co.* Plaintiff claims \$72,316.76 based upon alleged delays by Government in making available towers upon which the contractor was to string conductors. A hearing for the taking of testimony was held in Los Angeles, Calif., in June 1956. No report has yet been made by the Hearing Commissioner.

2. *Abbett Electric Corp. v. United States.* Claim was in the amount of \$53,335.13 for increased costs due to Government delays in furnishing completely erected towers on which the contractor was to string conductors. A hearing for taking of testimony was held in San Francisco in January 1956.

3. *Lym Engineering Co. v. United States.* This case arose out of a private relief bill introduced in the Congress to relieve the contractor of losses incurred after August 14, 1945, in performing a Reclamation contract. Pre-August 14, 1945, losses had previously been allowed by the Department under the terms of the War Hardship Claims Act. The case was referred to the Court of Claims for a report to the Congress as to the merits of the claim and the amount, if any, legally or equitably due the claimant. The Commissioner of the Court of Claims filed a report on June 27, 1957, finding that the contractor suffered losses after August 14, 1945, in the amount of \$111,080.60. There has been no determination of the standing of the claim as legal or equitable against the Government.

4. *J. D. Armstrong, Inc. v. United States.* The petition filed by the contractor requests relief in the amount of \$65,413.00 based upon four separate claims involving alleged changes, changed conditions, contract interpretation, and breach of contract. Litigation report has been made to the Department of Justice. An answer has been filed denying liability.

5. *Thomas A. Hellander v. United States*. This case was submitted to the Congress as a claim for relief, and was referred to the Court of Claims for a report. Plaintiff, who reserved no claims in his release on contract, claims \$66,349.30 based upon allegedly erroneous contract interpretations and for losses and damages allegedly incurred due to deficient specifications, premature use of completed work and other causes. Litigation report has been made to the Department of Justice. An answer has been filed denying liability.

6. *Arthur L. Murphy v. United States, Court of Claims No. 39-57*. The contractor filed a petition which claims \$754,472 for allegedly wrongful termination of contractor's right to proceed. A litigation report has been made to the Department of Justice.

BONNEVILLE POWER ADMINISTRATION

William A. Pearl, *Administrator*



FINANCIAL RESULTS OF OPERATIONS

INSTALLED CAPACITY for the Columbia River power system increased by 551,000 kilowatts during the fiscal year. This increase resulted from the installation and placing in service of six 64,000 kilowatt generating units at the Chief Joseph project; two 70,000 kilowatt units at the McNary project and two 13,500 kilowatt fishway units at the Dalles project. The total installed capacity for the system at the end of fiscal year 1957 was 4,702,000 kilowatts.

Actual revenues for 1957 fell below expected amounts because some industrial customers were required to curtail their loads and because lower than average water conditions resulted in less interruptible power available for sale.

Gross revenues increased \$5,407,344 or 8.87 percent over the previous year for a total of \$66,399,967. After provisions for all costs of operation, including maintenance charges, interest and depreciation expense and miscellaneous charges, net revenues for the year amounted to \$5,965,732. The net revenues for fiscal year 1956 were \$5,949,412.

Table I presents a combined statement of revenues and expenses for the system. The data are prepared from commercial cost accounts kept in accordance with the Federal Power Commission's system of accounts prescribed for electric utilities.

Summary of Revenue

Table II summarizes by customer categories the source of revenues by fiscal years to and including 1957. The aluminum industry accounted for 30.16 percent of the revenue dollar for fiscal year 1957, while industries other than aluminum accounted for 12.73 percent

making a total of 42.89 percent of the gross revenues for the year provided by industrial customers.

Sales to publicly owned utilities were 33.20 percent of the total and privately owned utilities 21.76 percent. Other operating revenues amounted to 2.15 percent.

Increased sales occurred in all categories except aluminum. Sales to aluminum industries decreased \$72,410. Sales to other industries increased \$264,462 as compared with the previous year; publicly owned utilities \$2,539,600, and privately owned utilities \$2,450,633.

Repayment of Federal Investment

The gross Federal investment in the power portion of all the generating projects in operation and in related transmission facilities comprises the total of all funds appropriated and requisitioned for construction and operations, together with indirect items such as WPA expenditures and amounts transferred from other Federal agencies, plus interest at 2½ percent on the unrepaid balance.

TABLE I.—*Columbia River power system—condensed summary of revenues and expenses—operating projects only*

| | Fiscal year 1956 | Fiscal year 1957 | Total to June 30, 1957 |
|---|---------------------|---------------------|---------------------------|
| Operating revenues..... | \$60,992,623 | \$66,399,967 | \$529,205,859 |
| Expenses of operation, maintenance, etc..... | 14,865,090 | 16,257,354 | 139,593,091 |
| Provision for depreciation..... | 18,539,972 | 20,255,154 | 121,602,831 |
| Interest expense..... | 21,691,302 | 24,015,702 | 161,718,043 |
| Miscellaneous deductions, etc..... | (53,153) | (93,945) | 1,580,555 |
| Total deductions..... | 55,043,211 | 60,434,235 | 424,494,520 |
| Accumulated net revenues from operations..... | 5,949,412 | 5,965,732 | 104,711,339 |

TABLE II.—*Revenue by class of customers through fiscal year 1957*

| Class of customer | 1952 and prior | 1953 | 1954 | 1955 | 1956 | 1957 | Total to June 30, 1957 | 1957 per- centage (dollar revenue) |
|-----------------------------------|-------------------|--------------|--------------|--------------|--------------|--------------|------------------------------|---|
| Industry: | | | | | | | | |
| Aluminum..... | \$114,449,047 | \$13,545,562 | \$15,944,356 | \$16,909,588 | \$20,098,110 | \$20,025,700 | \$200,972,363 | 30.16 |
| Other..... | 29,540,568 | 4,715,747 | 5,417,177 | 6,821,850 | 8,186,874 | 8,451,336 | 63,133,552 | 12.73 |
| Publicly owned utilities..... | 51,942,782 | 13,882,890 | 14,882,997 | 17,601,135 | 19,505,231 | 22,044,831 | 139,859,866 | 33.20 |
| Privately owned utilities..... | 63,271,265 | 6,239,276 | 7,882,879 | 9,926,150 | 11,999,475 | 14,450,108 | 113,769,153 | 21.76 |
| Other operating revenue..... | 6,050,223 | 791,734 | 1,190,284 | 807,759 | 1,202,933 | 1,427,992 | 11,470,925 | 2.15 |
| Total operating revenue..... | 265,253,885 | 39,175,209 | 45,317,693 | 52,066,482 | 60,992,623 | 66,399,976 | 529,205,859 | 100.00 |

¹ Includes sales to Federal agencies.

As of June 30, 1957, this investment amounted to \$1,815,879,985, as shown in table IV. This includes accumulated interest in the amount of \$231,195,777. A summary of the interest accumulation is shown in table III.

With the exception of the amounts transferred to the continuing fund, all receipts from power sales and miscellaneous sources allocated to power are deposited in the Treasury to repay the Federal investment.

As of June 30, 1957, repayments total \$512,476,083, leaving an unpaid balance of \$1,303,403,902. Of the total repaid, \$285,651,379 represents payment of all current expenses since inception of the program. The remaining amount of \$226,824,704 is repayment on the capital investment of \$1,530,228,606 as shown in table IV.

A summary of plant accounts as of June 30, 1957, is shown in table V.

Based on individual projects the return of power capital investment has been as follows:

TABLE III.—*Columbia River power system—summary of interest on Federal investment as of June 30, 1957*

Interest during construction, to be returned during
repayment period as part of the Federal investment:

| | |
|--------------------------------------|---------------|
| Bonneville Power Administration..... | \$6, 649, 979 |
| Bonneville Dam project..... | 2, 333, 827 |
| Columbia Basin project..... | 9, 687, 396 |
| Hungry Horse project..... | 4, 708, 543 |
| McNary Dam project..... | 19, 771, 439 |
| Albeni Falls project..... | 1, 029, 564 |
| Detroit-Big Cliff project..... | 2, 593, 463 |
| Lookout Point-Dexter project..... | 2, 880, 490 |
| Chief Joseph project..... | 10, 422, 388 |
| Chandler project..... | 124, 808 |
| The Dalles project..... | 9, 275, 837 |

| | |
|---------------|----------------|
| Subtotal..... | \$69, 477, 734 |
|---------------|----------------|

Interest charged to operations:

| | |
|--------------------------------------|----------------|
| Bonneville Power Administration..... | \$50, 226, 701 |
| Bonneville Dam project..... | 20, 845, 492 |
| Columbia Basin project..... | 56, 865, 775 |
| Hungry Horse project..... | 9, 126, 544 |
| McNary Dam project..... | 13, 937, 468 |
| Albeni Falls project..... | 2, 186, 942 |
| Detroit-Big Cliff project..... | 3, 633, 986 |
| Lookout Point-Dexter project..... | 2, 291, 228 |
| Chief Joseph project..... | 2, 470, 164 |
| Chandler project..... | 117, 060 |
| The Dalles project..... | 16, 683 |

| | |
|---------------|---------------|
| Subtotal..... | 161, 718, 043 |
|---------------|---------------|

| | |
|----------------------------------|---------------|
| Gross interest accumulation..... | 231, 195, 777 |
|----------------------------------|---------------|

TABLE IV.—*Columbia River power system—summary of Federal investment in operating power projects and repayment as of June 30, 1957*

| | Gross investment | Repayments | Net investment |
|--|------------------|---------------|-----------------|
| Investment in current expenses: | | | |
| Operation, maintenance, etc..... | \$123,933,336 | \$123,933,336 | ----- |
| Interest ¹ | 161,718,043 | 161,718,043 | ----- |
| Total current expenses..... | 285,651,379 | 285,651,379 | ----- |
| Investment in capital assets: | | | |
| Electric plant investment ² | 1,555,190,364 | | |
| Unexpended appropriations..... | 24,961,758 | | |
| Total capital investment..... | 1,580,228,606 | 226,824,704 | \$1,303,403,902 |
| Total Federal investment..... | 1,815,879,985 | 512,476,083 | 1,303,403,902 |

¹ The Columbia River power system does not receive appropriations for payment of interest, but imputes and includes in its accounts provisions for interest expense and returns receipts to the Treasury in repayment of such expenses.

² Includes interest during construction of \$69,477,734 which will be repaid to the Treasury as part of capital cost of electric plant.

TABLE V.—*Columbia River power system summary of plant accounts in operating projects as of June 30, 1957*

| Project | Total | Allocation | |
|---|---------------|--------------|---------------|
| | | Nonpower | Power |
| Bonneville Power Administration..... | \$419,386,054 | | \$419,386,054 |
| Bonneville Dam project..... | 86,703,455 | \$27,194,875 | 59,508,580 |
| Columbia Basin project..... | 513,420,261 | 308,591,021 | 204,829,240 |
| Hungry Horse project..... | 107,574,282 | 20,667,974 | 86,906,308 |
| Albani Falls project..... | 31,275,645 | 286,788 | 30,988,857 |
| McNary Dam project..... | 303,978,954 | 25,816,845 | 278,162,109 |
| Detroit-Big Cliff project..... | 65,772,144 | 24,153,158 | 41,618,986 |
| Lookout Point-Dexter project..... | 92,547,552 | 51,129,756 | 41,417,796 |
| Chief Joseph project..... | 148,830,552 | 1,151,051 | 147,679,501 |
| Chandler project..... | 14,244,157 | 10,547,766 | 3,696,391 |
| The Dalles project..... | 217,302,021 | 21,078,411 | 196,223,610 |
| Total plant..... | 2,001,035,077 | 490,617,645 | 1,510,417,432 |
| Less combined reserve for depreciation..... | | | 110,887,645 |
| Total less reserve..... | | | 1,399,529,787 |

| Project | Power capital investment ¹ | Repaid as of June 30, 1957 | Percent repaid | Net power investment ¹ |
|--------------------------------------|---------------------------------------|----------------------------|--------------------|-----------------------------------|
| Bonneville Power Administration..... | \$440,140,333 | \$112,143,555 | 25.48 | \$327,996,778 |
| Bonneville Dam..... | 59,883,099 | 25,904,231 | 43.26 | 33,978,868 |
| Columbia Basin project..... | 207,365,383 | 58,513,519 | 28.22 | 148,851,864 |
| Hungry Horse..... | 87,513,455 | 5,939,161 | 6.79 | 81,574,294 |
| Albani Falls..... | 30,948,092 | 1,060,769 | 3.43 | 29,887,323 |
| McNary..... | 277,459,591 | 16,999,126 | 6.13 | 260,460,465 |
| Detroit-Big Cliff..... | 41,820,544 | 2,701,807 | 6.46 | 39,118,737 |
| Lookout Point-Dexter..... | 41,396,107 | 1,779,816 | 4.30 | 39,616,291 |
| Chief Joseph..... | 146,564,404 | 1,552,355 | 1.06 | 145,012,049 |
| Chandler..... | 3,691,747 | 201,886 | 5.47 | 3,489,861 |
| The Dalles..... | 193,445,851 | 28,479 | .01 | 193,417,372 |
| Total..... | 1,530,228,606 | 226,824,704 | ² 14.82 | 1,303,403,902 |

¹ Exclusive of unexpended funds in U. S. Treasury.

² This overall total of 14.82 percent is less than the corresponding result of 15.68 percent shown as of the end of the preceding fiscal year because of the inclusion of The Dalles project, representing a very substantial investment but with practically no commercial operations in 1957. In fact, only the 2 small fishway units were in commercial service in 1957 and even these were on the line for only a few weeks. Exclusive of The Dalles project, the overall percentage for this table would be 16.97 percent. For every project in the list other than The Dalles, the percentage of repayment increased over the corresponding amount a year earlier.

The data in this table are based on cost accounts maintained in accordance with the Federal Power Commission uniform system of accounts.

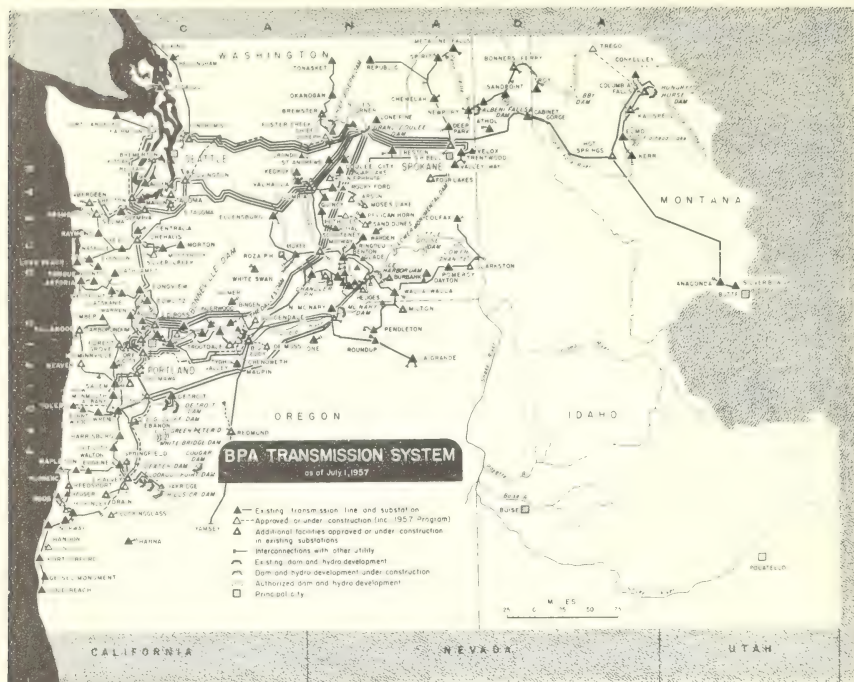


FIGURE 6.

SUMMARY OF OPERATIONS

Energy Production

Almost 30 billion kilowatt-hours of electric energy were generated at the 12 Federal plants for the Administration during fiscal year 1957. This was an increase of 8.6 percent over fiscal year 1956. One new plant, The Dalles, was connected to the system during the year. In addition, six new units at Chief Joseph and two at McNary were brought into production during the year.

New System Peak

A new system peak was established during the 6-7 p. m. hour on January 25, 1957, before The Dalles plant, the eighth and ninth units at Chief Joseph, and the last two units at McNary were in operation. Maximum coincident demand on the 11 Federal plants was 4,887,000 kilowatts, an increase of 9.1 percent over the previous fiscal year's maximum demand of 4,479,000 kilowatts, which occurred on February 1, 1956. Energy produced at Federal plants for the Administration is shown by years in table VI and illustrated in the ac-

companying chart. Prepared on a quarterly basis, the chart shows the general trends of the Bonneville Power Administration's system-load growth.

TABLE VI.—*Generation at Federal plants for the Bonneville Power Administration, fiscal years 1939–57*

BY FISCAL YEARS

| Fiscal years ending June 30 | Generation (thousands of kilo- watt-hours) | Maximum demand (kilowatts) | Load factor (percent) |
|-----------------------------|---|----------------------------------|-----------------------------|
| 1939–41 | 1, 144, 932 | 210, 000 | |
| 1942 | 2, 549, 153 | 468, 000 | 62. 2 |
| 1943 | 5, 618, 436 | 841, 000 | 76. 3 |
| 1944 | 9, 239, 823 | 1, 355, 000 | 77. 6 |
| 1945 | 9, 051, 573 | 1, 427, 000 | 72. 4 |
| 1946 | 6, 236, 163 | 1, 346, 000 | 52. 9 |
| 1947 | 8, 753, 737 | 1, 335, 000 | 74. 9 |
| 1948 | 10, 885, 907 | 1, 610, 000 | 77. 0 |
| 1949 | 12, 925, 788 | 1, 797, 000 | 82. 1 |
| 1950 | 14, 140, 834 | 2, 106, 000 | 76. 7 |
| 1951 | 16, 472, 384 | 2, 535, 000 | 74. 2 |
| 1952 | 18, 555, 401 | 2, 784, 000 | 75. 9 |
| 1953 | 17, 633, 232 | 2, 867, 000 | 70. 2 |
| 1954 | 20, 195, 833 | 3, 301, 000 | 69. 8 |
| 1955 | 23, 253, 186 | 3, 651, 000 | 72. 7 |
| 1956 | 27, 599, 380 | 4, 479, 000 | 70. 1 |
| 1957 | 29, 984, 224 | 4, 887, 000 | 70. 0 |
| Total | 234, 239, 986 | 4, 887, 000 | |

BY PLANTS

| | Generation ¹ (millions of kilowatt-hours) | | Date in service ² | Operating agency |
|----------------------------|---|--------------------------|---------------------------------|------------------|
| | Fiscal year 1957 | Total to July 1, 1957 | | |
| Albeni Falls | 253 | 511 | Mar. 25, 1955 | Army Engineers. |
| Bonneville | 4, 089 | 60, 164 | June 6, 1938 | Do. |
| Chandler | 65 | 91 | Feb. 13, 1956 | USBR. |
| Chief Joseph | 4, 321 | 6, 235 | Aug. 20, 1955 | Army Engineers. |
| Detroit ³ | 407 | 1, 645 | July 1, 1953 | Do. |
| Big Cliff | 101 | 307 | June 12, 1954 | Do. |
| Grand Coulee ⁴ | 13, 158 | 144, 042 | Sept. 28, 1941 | USBR. |
| Hungry Horse | 894 | 3, 864 | Oct. 29, 1952 | Do. |
| Lookout Point ³ | 386 | 1, 007 | Dec. 16, 1954 | Army Engineers. |
| Dexter | 72 | 168 | May 19, 1955 | Do. |
| McNary | 6, 223 | 16, 191 | Nov. 6, 1953 | Do. |
| The Dalles | 15 | 15 | May 13, 1957 | Do. |
| Total | 29, 984 | 234, 240 | | |

¹ Includes energy generated in testing new generating units.

² Date of commercial operations.

³ Excludes energy for condenser power at Detroit and Lookout Point.

⁴ Includes energy transferred for Bureau of Reclamation.

Receipts and Deliveries

Bonneville Power Administration's transmission grid forms the backbone of the interconnected transmission system of public and private utilities in the Pacific Northwest. As a result, electric energy receipts and deliveries on Bonneville's transmission system cover many complex transactions in addition to receipts from Federal power plants and deliveries by sales.

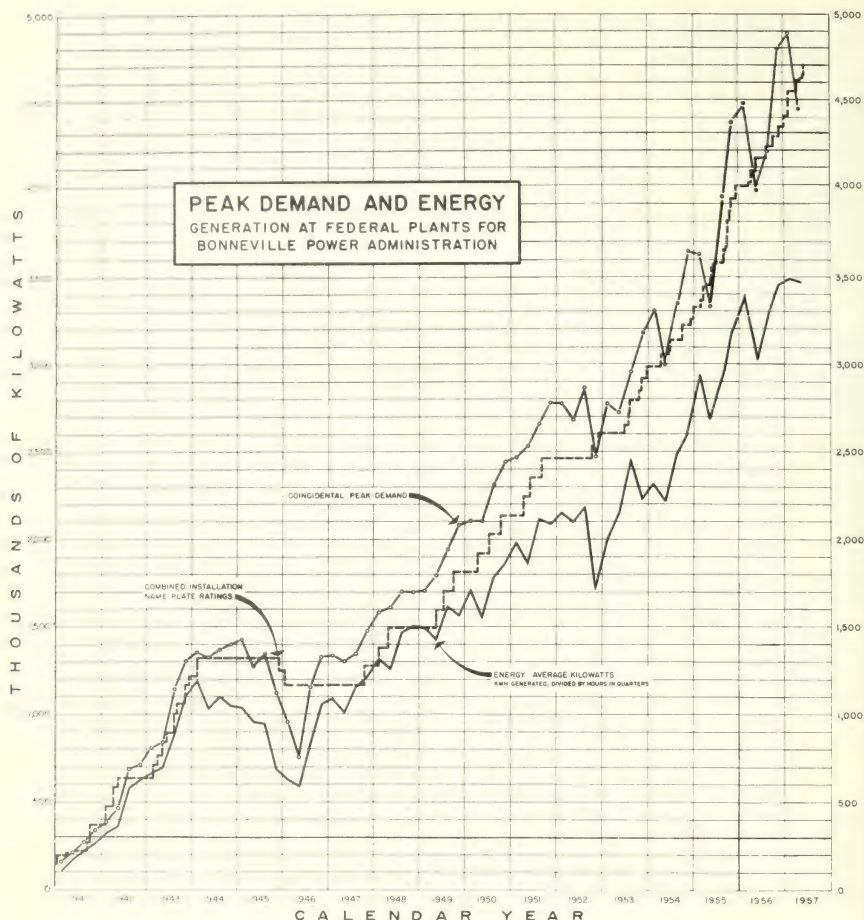


FIGURE 7.

The integrated transmission grid makes possible the fullest utilization of power facilities in the area through diversity in peaking and water capabilities and diversity of system-load conditions. Substantial quantities of energy are received and delivered as transfers from other utilities.

Transactions also involve storage by the Administration in non-Federal reservoirs as well as storage by non-Federal utilities in the Grand Coulee Reservoir. Disposition of energy includes deliveries from storage in Grand Coulee or to storage in other reservoirs, energy transfers for the Bureau of Reclamation from Grand Coulee, energy used by the Administration, and energy losses in transmission and transformation.

Table VII, electric energy account, summarizes energy receipts and deliveries for fiscal year 1957.

TABLE VII.—*Electric energy account for fiscal year 1957*

Energy received (millions of kilowatt-hours) :

| | |
|---|--------|
| Energy generated at Federal plants for BPA ¹ ----- | 29,984 |
| Power purchased and interchanged in----- | 4,284 |
| Total received----- | 34,268 |

Energy delivered (millions of kilowatt-hours) :

| | |
|-----------------------------|--------|
| Sales----- | 28,216 |
| Power interchanged out----- | 4,084 |
| Used by Administration----- | 31 |
| Total delivered----- | 32,331 |

| | |
|---|-----------|
| Energy losses in transmission and transformation----- | 1,937 |
| Losses as percent of total energy received—percent----- | 5.7 |
| Maximum demand on generating plants (kilowatts), January 25, 1957, 6-7 p. m., Pacific standard time----- | 4,887,000 |
| Load factor, total generated for BPA, percent----- | 70.0 |

¹ For detail by plants, see table VI.

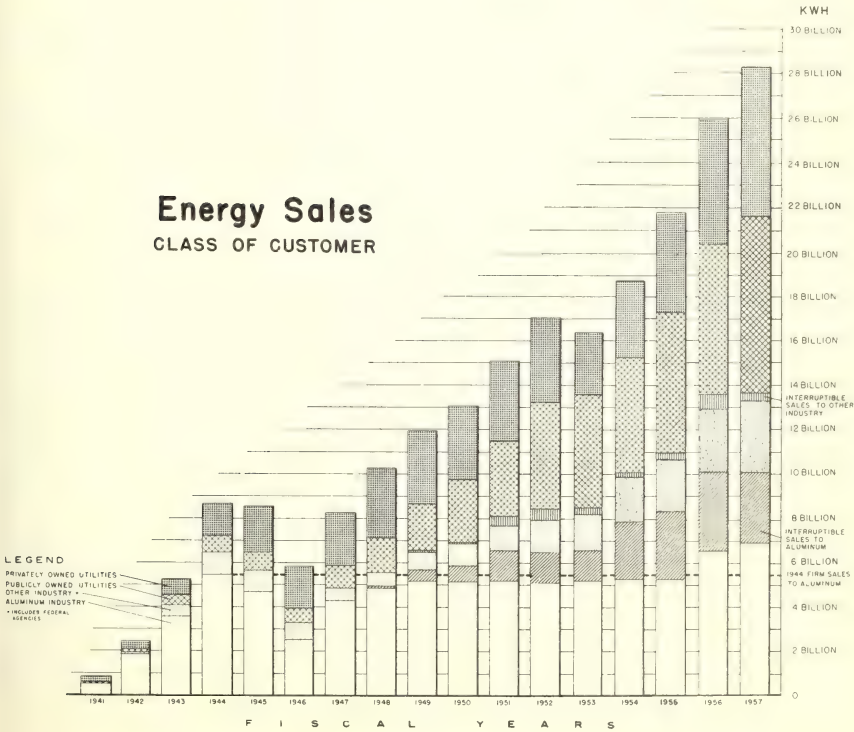


FIGURE 8.

Sale of 28 Billion Kilowatt-Hours

Energy sales to customers of the Bonneville Power Administration totaled 28 billion kilowatt-hours during the fiscal year 1957, an increase of 8.6 percent over 1956.

Sales of electric energy to other utilities, both publicly and privately owned, totaled 14.5 billion kilowatt-hours, an increase of 17.2 percent. Deliveries to industrial plants and Federal agencies totaled 13.7 billion kilowatt-hours, an increase of 0.8 percent.

During fiscal year 1957, BPA supplied 3.5 billion kilowatt-hours of interruptible energy to industrial customers. This was 82 percent of what these customers would have purchased had total requirements been available, and a decrease of 14.3 percent from fiscal year 1956 deliveries of interruptible energy. The power resources during the winter were inadequate and required a reduction in deliveries of interruptible energy to the industrial customers in order to meet the Administration's firm power commitments and requirements of higher priority customers.

The 3.5 billion kilowatt-hours of interruptible energy sales include 351 million kilowatt-hours and \$703,235 provisional sales to 13 industrial customers. These provisional sales were made possible by generation from storage releases beyond normal operating drawdown of reservoirs. Revenues are held in special deposit accounts to cover replacement of provisional energy during the next two fiscal years if required. During fiscal year 1956 there were no provisional energy sales.

Composite Average Rate of 2.37 Mills

The Administration has sold 218.6 billion kilowatt-hours of electric energy at a composite rate of 2.37 mills per kilowatt-hour during the 19 years of operation ended June 30, 1957. Sales to publicly owned utilities for the 19 years were 49.9 billion kilowatt-hours at an average of 2.80 mills. Privately owned utilities received 49.6 billion kilowatt-hours at an average of 2.29 mills, and industries 119.1 billion kilowatt-hours at 2.22 mills.

Power sales to aluminum plants were 95.2 billion kilowatt-hours at an average of 2.11 mills. These plants characteristically take power at very high load factors, approaching 100 percent, which results in the exceptionally low average cost on the Administration's C and A rate schedules. Sales to industries other than aluminum, including sales to Federal agencies, were 23.9 billion kilowatt-hours at an average of 2.63 mills.

TABLE VIII.—*Electric energy sales by class of customer, fiscal years 1939–57*

[Millions of kilowatt-hours]

| Fiscal years ending June 30 | Aluminum | Other industries ¹ | Publicly owned utilities | Privately owned utilities | Total |
|-----------------------------|---------------------|-------------------------------|--------------------------|---------------------------|----------------------|
| 1939-41 | 523 | 5 | 35 | 537 | 1,100 |
| 1942 | 1,845 | 79 | 143 | 358 | 2,425 |
| 1943 | 3,589 | 507 | 435 | 739 | 5,270 |
| 1944 | 5,454 | 1,022 | 728 | 1,467 | 8,671 |
| 1945 | 4,667 | 965 | 824 | 2,057 | 8,513 |
| 1946 | 2,492 | 800 | 636 | 1,903 | 5,831 |
| 1947 | 4,212 | 627 | 1,045 | 2,378 | 8,262 |
| 1948 | 4,902 | 647 | 1,561 | 3,181 | 10,291 |
| 1949 | 5,666 | 881 | 2,081 | 3,342 | 11,970 |
| 1950 | 5,863 | 1,024 | 2,840 | 3,312 | 13,039 |
| 1951 | 6,545 | 1,538 | 3,414 | 3,579 | 15,076 |
| 1952 | 6,472 | 1,943 | 4,804 | 3,794 | 17,013 |
| 1953 | 6,547 | 1,947 | 5,110 | 2,791 | 16,395 |
| 1954 | ² 7,862 | 2,254 | 5,127 | 3,531 | ² 18,774 |
| 1955 | ² 8,352 | 2,624 | 6,274 | 4,578 | ² 21,828 |
| 1956 | 10,140 | 3,422 | 6,909 | 5,500 | 25,971 |
| 1957 | ² 10,096 | ² 3,581 | 7,970 | 6,569 | ² 28,216 |
| Total to July 1, 1957 | ² 95,227 | ² 23,866 | 49,936 | 49,616 | ² 218,645 |

¹ Includes Federal agencies.² Includes provisional energy sales to industries:

| | Aluminum | Other industries |
|--------------|-------------------|------------------|
| Fiscal year: | | |
| 1954 | 28,355 mwh | |
| 1955 | 22,956 mwh | |
| 1957 | 323,509 mwh | 27,817 mwh. |

Rate Schedules

During the last fiscal year almost three-quarters of the energy sales were made under the C-4 wholesale rate schedule at an average rate of 2.12 mills per kilowatt-hour. This is the kilowatt-year rate for firm power delivered anywhere from the transmission system, and is also used with special measured demand provisions for sales of interruptible power. Sales are generally made under this rate to industries operating at high load factor and to utilities having substantial generating facilities. Other sales were made principally under the E-4 rate schedule to utilities purchasing all or substantially all of their power requirements from the Administration. At-site power is sold under the A-4 rate. Sales under the F-4 schedule were made to the utilities and industries requiring power at low-load factor use, and under the H schedule for dump, exchange, or experimental purposes. A summary of energy sales for the fiscal year 1957 classified by rate schedules is shown in table IX.

A special review of the Administration's rate structure by the Ford, Bacon & Davis Co. was completed during the 1956 fiscal year. Study of this special report by the staff was continued during this last year.

Special study by the staff was directed during fiscal year 1957 to

review of the Administration's entire present wholesale rate structure and to development of a rate by which low availability secondary energy in excess of that sold under present rates can be marketed.

TABLE IX.—*Electric energy sales by rate schedules during fiscal year 1957*

| Rate schedule | Energy (thousands of kilowatt- hours) | Revenue ¹ | Mills per kilowatt- hour |
|--|---|---------------------------|--------------------------------|
| C-4: | | | |
| Industries | ² 12,352,068 | ² \$25,942,951 | 2.10 |
| Utilities | 8,530,229 | 18,352,171 | 2.15 |
| Subtotal | 20,882,297 | 44,295,122 | 2.12 |
| F-4: | | | |
| Industries | 14,298 | 63,487 | 4.44 |
| Utilities | 65,928 | 290,059 | 4.40 |
| Subtotal | 80,226 | 353,546 | 4.41 |
| A-4: | | | |
| Industries | ² 1,081,214 | ² 1,807,016 | 1.67 |
| Utilities | 11,818 | 43,947 | 3.72 |
| Subtotal | 1,093,032 | 1,850,963 | 1.69 |
| E-4: Utilities ³ | 4,315,673 | 13,649,520 | 3.16 |
| Experimental, H-3 and exchange: Industries and utilities | 1,844,964 | 4,612,410 | 2.50 |
| Total | ² 28,216,192 | ² 64,761,561 | 2.30 |

¹ These revenues from sale of electric energy differ from official accounting records in that billing adjustments applicable to only fiscal year 1957 are included.

² Includes provisional sales.

| | Energy (thousands of kwh.) | Revenue |
|-----|----------------------------------|-----------|
| C-4 | 333,207 | \$673,028 |
| A-4 | 18,119 | 30,207 |
| | 351,326 | 703,235 |

³ Including Federal agency pumping loads.

Customers Served

The Administration was serving 114 customers during the fiscal year 1957 with no changes during the year. There were 76 publicly owned distributors of power, 18 industrial customers, 11 Federal agencies, and 9 privately owned utilities.

In order to improve services to these customers, 11 points of delivery were added during the year, bringing the total number of delivery points to 345 at the end of the 1957 fiscal year.

Generation Added

Additions to the United States Columbia River power system in fiscal year 1957 have a nameplate rating of 551,000 kilowatts. The

final two units with 140,000 kilowatts total capacity were installed at the McNary project on the Columbia River. Six units with a total capacity of 384,000 kilowatts were installed at Chief Joseph project on the Columbia River, leaving six units to be installed for the completed project. Two units in the fishway at The Dalles project with a total capacity of 27,000 kilowatts were installed. The Corps of Engineers is construction agency for all three of these projects.

Projects Summarized

Projects existing, under construction, and authorized for construction by the Corps of Engineers and Bureau of Reclamation are shown in table X. The existing projects and units installed to date in projects under construction will provide 3,584,000 kilowatts of prime power when operated as a system. With completion of the projects under construction the prime capability will be 5,394,000 kilowatts and with completion of the authorized projects prime capability will be over 6 million kilowatts.

Existing storage capacity usable for power in Federal reservoirs is 9,868,500 acre-feet. An additional 403,000 acre-feet will be provided by Cougar and Hills Creek on which construction is under way, and 5,343,000 acre-feet would be provided by Libby and Green Peter projects which are authorized for construction.

All generation and storage capacity, except the John Day project, will be in service by December 1961 under the present schedule. John Day project will be completed by June 1967. Service dates for the other authorized projects are not scheduled as no funds have been appropriated for their construction.

Non-Federal Additions

Non-Federal generating capacity in the area served by the Administration was increased in fiscal year 1957 by installation of the last of four units at Ross project by Seattle City Light. This unit, which has a nameplate rating of 90,000 kilowatts, began operation on November 19, 1956.

TABLE X.—U. S. Columbia River power system, general specifications, November 15, 1957—projects existing, under construction, and authorized—installations and capabilities correspond to a coordinated system operation

| Project | Location | Stream | Plant installations | | Nominal prime power (kilowatts) ² | Pool elevation (feet) | Usable storage (acre-feet) ⁴ | Date in service | | Principal purpose ³ |
|---------------------|-------------------|------------------------|---------------------|---|--|-----------------------|---|-----------------|----------------|--------------------------------|
| | | | Number of units | Total capacity (kilowatts) ¹ | | | | Initial unit | Last unit | |
| Existing: | | | | | | | | | | |
| Bonneville | Washington-Oregon | Columbia | 10 | 518, 400 | 466, 000 | 74 | Pondage | June 1938 | December 1943 | P, N. |
| Grand Coulee | Washington | do. | 18 | 1, 944, 000 | 1, 552, 000 | 1, 288 | 5, 072, 000 | September 1941 | September 1951 | P, I, F, C, N. |
| Hungry Horse | Montana | South Fork Flathead | 4 | 285, 000 | 196, 000 | 3, 560 | 2, 982, 000 | October 1952 | July 1953 | P, I, F, C, N. |
| Detroit | Oregon | North Santiam | 2 | 100, 000 | 39, 000 | 1, 503. 5 | 323, 000 | July 1953 | October 1953 | P, I, F, C, N. |
| McNary | Washington-Oregon | Columbia | 14 | 980, 000 | 549, 000 | 340 | Pondage | November 1953 | February 1957 | P, I, N. |
| Big Cliff | Oregon | North Santiam | 1 | 18, 000 | 11, 000 | 1, 206 | Pondage | June 1954 | June 1954 | P, I, F, C, N. |
| Lookout Point | do. | Middle Fork Willamette | 3 | 120, 000 | 34, 000 | 926 | 336, 500 | December 1954 | April 1955 | P, I, F, C, N. |
| Albeni Falls | Idaho | Pend Oreille | 3 | 42, 600 | 21, 000 | 2, 062. 5 | 1, 155, 000 | March 1955 | August 1955 | P, F, C, N. |
| Dexter | Oregon | Middle Fork Willamette | 1 | 15, 000 | 11, 000 | 695 | Pondage | May 1955 | May 1955 | P, I, N. |
| Chief Joseph | Washington | Columbia | 12 | 768, 000 | 768, 000 | 946 | Pondage | August 1955 | October 1957 | P, I. |
| Chandler | do. | Yakima | 2 | 12, 000 | 11, 000 | 618. 5 | 118 | February 1956 | February 1956 | P, I. |
| The Dalles | Washington-Oregon | Columbia | 4 | 183, 000 | 156, 000 | 160 | Pondage | May 1957 | November 1957 | P, N. |
| | | | | 4, 986, 000 | 3, 804, 000 | | 9, 868, 500 | | | |
| Under construction: | | | | | | | | | | |
| Chief Joseph | Washington-Oregon | do. | 4 | 256, 000 | 88, 000 | 946 | Pondage | January 1958 | December 1958 | P, I. |
| The Dalles | Washington-Oregon | do. | 12 | 936, 000 | 518, 000 | 160 | Pondage | February 1958 | November 1960 | P, N. |
| Roza | Washington | Yakima | 1 | 11, 250 | 6, 000 | 1, 220. 6 | Pondage | May 1958 | May 1958 | P, I. |
| Cougar | Oregon | South Fork McKenzie | 2 | 25, 000 | 17, 000 | 1, 690 | 154, 000 | November 1961 | November 1961 | P, I, F, C, N. |
| Hills Creek | do. | Middle Fork Willamette | 2 | 30, 000 | 16, 000 | 1, 543 | 249, 000 | November 1961 | November 1961 | P, I, F, C, N. |
| Ice Harbor | Washington | Snake | 3 | 270, 000 | 171, 000 | 440 | Pondage | December 1961 | December 1961 | P, I, N. |
| John Day | Washington-Oregon | Columbia | 12 | 1, 200, 000 | 774, 000 | 262 | Pondage | October 1965 | June 1967 | P, I, F, C, N. |
| | | | | 2, 728, 250 | 1, 590, 000 | | 403, 000 | | | |

| Authorized: | Montana | Kootenai | | 516,000 | 257,000 | 2,459 | 5,010,000 | | | |
|---------------------|------------|----------------|---|-----------|-----------|-------|------------|-----|-------|--------------|
| Libby | Washington | Snake | 6 | 270,000 | 169,000 | 533 | Pondage | 265 | ..... | P, FC, N. |
| Lower Monumental | do. | do. | 3 | | | | | 92 | ..... | P, I, N. |
| Little Goose | do. | do. | 3 | 270,000 | 180,000 | 633 | Pondage | 99 | ..... | P, N. |
| Lower Granite | do. | do. | 3 | 225,000 | 146,000 | 715 | Pondage | 80 | ..... | P, N. |
| Green Peter | Oregon | Middle Santiam | 2 | 81,000 | 22,000 | 984 | 333,000 | 250 | ..... | P, I, FC, N. |
| White Bridge | do. | do. | 1 | 15,000 | 9,000 | 670 | Pondage | 90 | ..... | P. |
| | | | | 1,377,000 | 783,000 | | 5,343,000 | | | |
| | | | | | 3-31,000 | | | | | |
| Total, 23 projects, | | | | 9,091,250 | 6,146,000 | | 15,614,500 | | | |

supply that part of irrigation water at Grand Coulee during the storage release period for 600,000 acres of the Columbia Basin project.

⁴ Storage usable for power production.

³ P—Power; I—Irrigation; FC—Flood control; N—Navigation.

¹ Nameplate rating.

² Average capability in a coordinated system during an 8-month storage release period (September 1936 through April 1937).

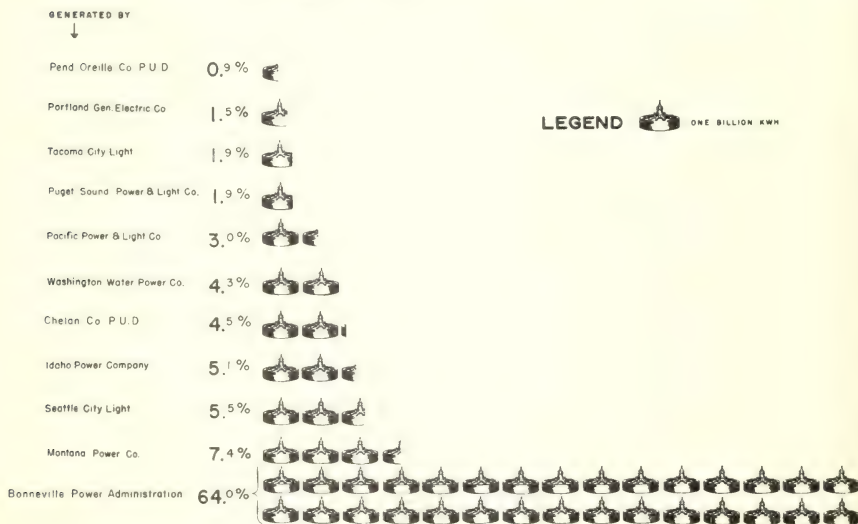
³ Pumping requirements of 31,000 kw. represents the average power necessary to

The Puget Sound Power & Light Co. added unit No. 7 of 20,000 kilowatts at the Snoqualmie Falls plant shortly after the close of fiscal year 1957. Future additions licensed for construction by non-Federal utilities in this area are shown in table XI. These additions represent an increase of 410,000 kilowatts of nameplate rating over projects in a comparable status one year previously.

Northwest Power Pool

Generation by the principal electric utility systems of the Pacific Northwest during the fiscal year 1957 is shown in table XII. All utilities listed are members of the Northwest power pool with the exceptions of the Chelan County and Pend Oreille County Public Utility Districts. These two utilities are included because they provided substantial amounts of generation to the pool. The Utah Power & Light Co. and the British Columbia Electric Co. are members of the pool but are not included as their major service areas are outside the region.

Power Generated BY THE PRINCIPAL ELECTRIC UTILITIES OF THE PACIFIC NORTHWEST YEAR ENDED JUNE 30, 1957



TOTAL 46.9 BILLION KWH

SOURCE WEEKLY OPERATING REPORTS OF N.W. POWER POOL

THE ABOVE UTILITIES ARE MEMBERS OF THE NORTHWEST POWER POOL EXCEPT FOR CHELAN CO. AND PEND OREILLE PUBLIC UTILITY DISTRICTS. UTAH POWER & LIGHT CO. AND BRITISH COLUMBIA ELECTRIC CO. ARE ALSO POOL MEMBERS BUT ARE NOT INCLUDED IN THIS CHART BECAUSE THEIR MAJOR SERVICE AREAS LIE OUTSIDE THE PACIFIC NORTHWEST REGION.

FIGURE 9.

A total of 64.0 percent of the energy generated by the major utilities of the region was produced by the United States Columbia River power system. In addition to power requirements of utilities and major industries served through the Administration's transmission system, 8.6 billion kilowatt-hours of energy were provided to other pool utilities for meeting their requirements.

Northwest Power Pool

OPERATIONS YEAR ENDING JUNE 30, 1957

BPA SUPPLIED 76% OF NET ENERGY REQUIREMENTS OF POWER POOL UTILITIES

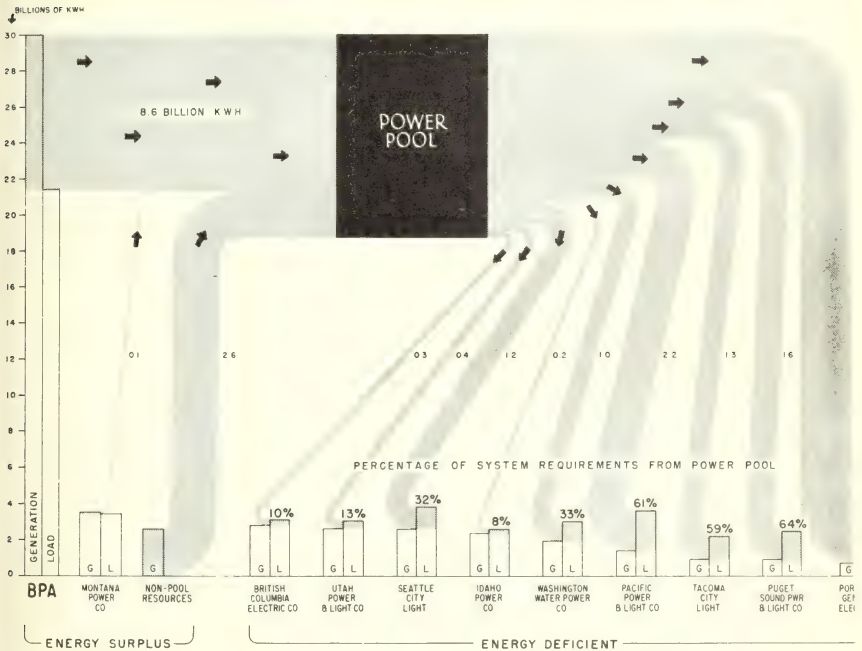


FIGURE 10.

TABLE XI.—Non-Federal utilities generator installation schedule, Aug. 12, 1957

| Utility and plant | Stream | Unit No. | Nameplate rating (thousands of kilowatts) | Date in service |
|---|----------------------|--------------|---|-----------------|
| Portland General Electric Co.: | | | | |
| Pelton..... | Deschutes River..... | 1 | 36 | November 1957. |
| | | 2 | 36 | January 1958. |
| | | 3 | 36 | February 1958. |
| North Fork..... | Clackamas River..... | 1 | 19.2 | July 1958. |
| | | 2 | 19.2 | September 1958. |
| Faraday (addition)..... | do..... | 6 | 19.2 | November 1958. |
| City of Seattle: | | | | |
| Diablo (reconstruction)..... | Skagit River..... | 1 and 2 | (1) | August 1958. |
| Gorge (reconstruction)..... | do..... | | (2) | August 1959. |
| Pacific Power & Light Co.: | | | | |
| Merwin (addition)..... | Lewis River..... | 3 | 45 | December 1958. |
| Swift No. 1..... | do..... | 1, 2, and 3. | 204 | December 1958. |
| Cowlitz County Public Utility District: | | | | |
| Swift No. 2..... | do..... | 1 and 2 | 70 | December 1958. |
| Grant County Public Utility District: | | | | |
| Priest Rapids..... | Columbia River..... | 1 | 78.85 | April 1959. |
| | | 2 | 78.85 | June 1959. |
| | | 3 | 78.85 | August 1959. |
| | | 4 | 78.85 | October 1959. |
| | | 5 | 78.85 | December 1959. |
| | | 6 | 78.85 | February 1960. |
| | | 7 | 78.85 | April 1960. |
| | | 8 | 78.85 | June 1960. |
| Wanapum..... | do..... | 1 | 75 | May 1962. |
| | | 2 | 75 | July 1962. |
| | | 3 | 75 | September 1962. |
| | | 4 | 75 | November 1962. |
| | | 5 | 75 | January 1963. |
| | | 6 | 75 | March 1963. |
| | | 7 | 75 | May 1963. |
| | | 8 | 75 | July 1963. |
| Puget Sound Power & Light Co.: | | | | |
| Upper Baker..... | Baker River..... | 1 and 2 | 85 | September 1959. |
| Lower Baker (addition)..... | do..... | 3 | 55 | September 1960. |
| Washington Water Power Co.: | | | | |
| Noxon Rapids..... | Clark Fork..... | 1 | 84 | September 1959. |
| | | 2 | 84 | December 1959. |
| | | 3 | 84 | March 1960. |
| | | 4 | 84 | June 1960. |
| City of Eugene: | | | | |
| Beaver Marsh..... | McKenzie River..... | 1 and 2 | 30 | July 1960. |
| City of Tacoma: | | | | |
| Mayfield..... | Cowlitz River..... | 1 | 40 | October 1960. |
| | | 2 | 40 | January 1961. |
| | | 3 | 40 | April 1961. |
| | | 4 | 40 | July 1961. |
| Mossyrock..... | do..... | 1 | 75 | April 1963. |
| | | 2 | 75 | July 1963. |
| | | 3 | 75 | October 1963. |
| | | 4 | 75 | December 1963. |
| Chelan County Public Utility District: | | | | |
| Rocky Reach..... | Columbia River..... | 1 | 101.65 | July 1961. |
| | | 2 | 101.65 | August 1961. |
| | | 3 | 101.65 | September 1961. |
| | | 4 | 101.65 | November 1961. |
| | | 5 | 101.65 | January 1962. |
| | | 6 | 101.65 | March 1962. |
| | | 7 | 101.65 | May 1962. |

¹ Reconstruction of the turbines will increase peaking capability by 25,000 kilowatts.

² Reconstruction of diversion dam will increase gross head by 100 feet and peaking capability by 57,000 kilowatts.

TABLE XII.—*Generation by the principal electric utility systems of the Pacific Northwest, fiscal year 1957*¹

| Utilities | Kilowatt-hours (billion) | Percent of total generation |
|--|-----------------------------|-----------------------------------|
| Publicly owned: | | |
| Bonneville Power Administration..... | 30.0 | 64.0 |
| Seattle City Light..... | 2.6 | 5.5 |
| Chelan County Public Utility District..... | 2.1 | 4.5 |
| Tacoma City Light..... | .9 | 1.9 |
| Pend Oreille County Public Utility District..... | .4 | .9 |
| Total publicly owned..... | 36.0 | 76.8 |
| Privately owned: | | |
| Montana Power Co..... | 3.5 | 7.4 |
| Idaho Power Co..... | 2.4 | 5.1 |
| Washington Water Power Co..... | 2.0 | 4.3 |
| Pacific Power & Light Co..... | 1.4 | 3.0 |
| Puget Sound Power & Light Co..... | .9 | 1.9 |
| Portland General Electric Co..... | .7 | 1.5 |
| Total privately owned..... | 10.9 | 23.2 |
| Total generation..... | 46.9 | 100.0 |

¹ Generation shown is for members of the Northwest power pool plus Chelan County and Pend Oreille County Public Utility Districts. Utah Power & Light Co. and British Columbia Electric Co. who are members of the power pool are not included because their service areas lie outside the Pacific Northwest region.

Transmission System Additions

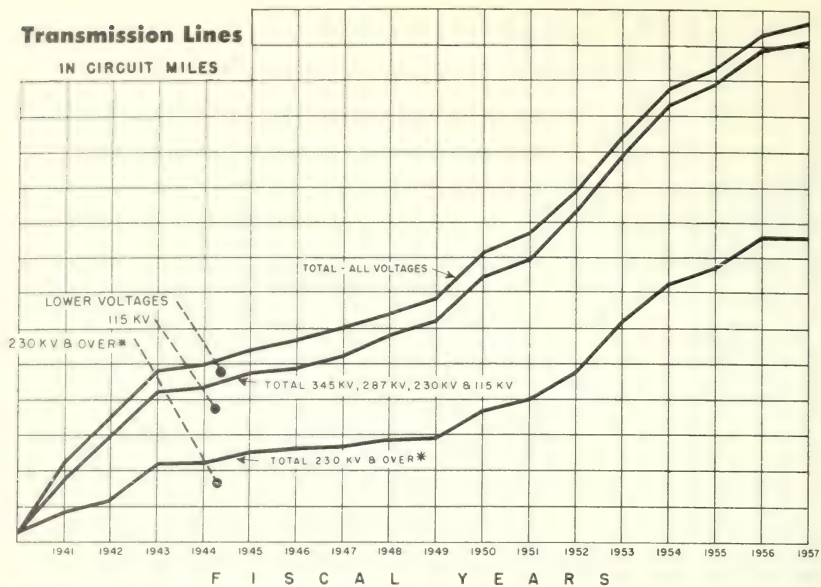
Bonneville Power Administration grid was increased during the fiscal year to 7,318 circuit miles of transmission line and 183 substations with a transformer capacity of 10,775,915 kilovolt-amperes.

Total circuit miles of transmission line include 175 of 345,000 volts, 231 of 287,000 volts, 3,884 of 230,000 volts, 2,795 of 115,000 volts, and 233 circuit miles of lower voltage lines.

Six new substations ranging from 3,000 to 250,000 kilovolt-amperes were energized during the year, one was retired, and transformers, including force-cooling equipment, ranging from 3,000 to 600,000 kilovolt-amperes was added to 24 existing substations. These additions increased the transformer capacity of the system by 2,767,165 kilovolt-amperes, or 35 percent.

Construction Program

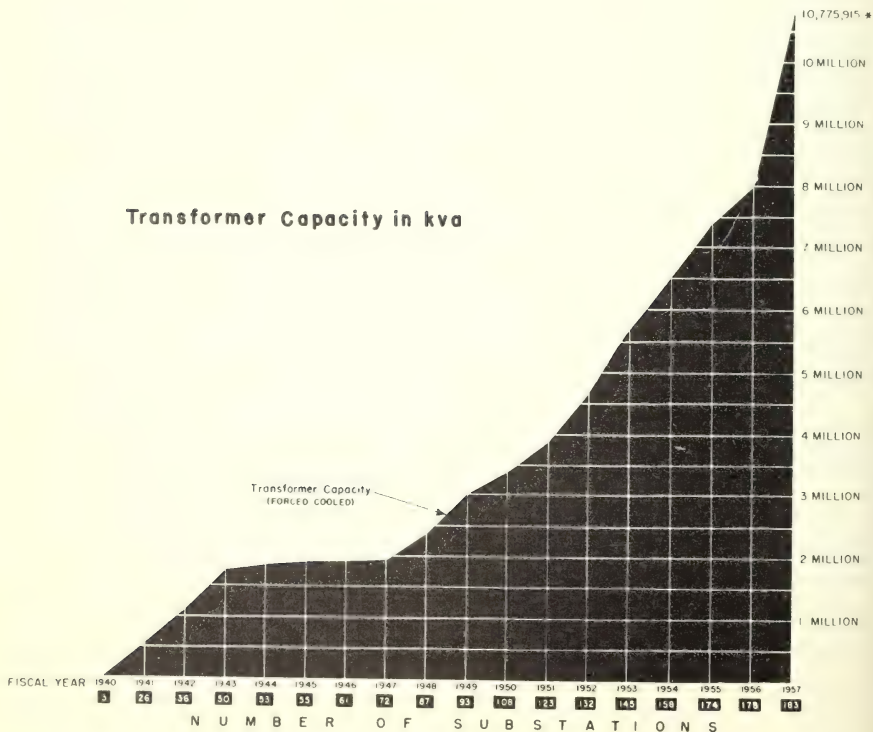
Major grid additions completed during the fiscal year include the McNary-J. D. Ross 345,000 volt transmission line and 600,000 kilovolt-ampere autotransformer banks, serving Portland-Vancouver load centers; the J. D. Ross-Keeler transmission line and 250,000 kilovolt-ampere Keeler substation serving Portland and upper Willamette Valley; a 250,000 kilovolt-ampere transformer bank at Big Eddy substation for service to The Dalles area; the Olympia-Shelton 230,000 volt transmission line and 250,000 kilovolt-ampere transformer bank No. 2 at Olympia substation, serving the Olympic Peninsula; a



* INCLUDES 230.5 MILES 287 KV & 174.7 MILES 345 KV

Note: VOLTAGES SHOWN ARE OPERATING VOLTAGES

FIGURE 11.



* INCLUDES 1,600,000 KVA OF AUTOTRANSFORMERS OPERATED AS PART OF TRANSMISSION LINES

FIGURE 12.

250,000 kilovolt-ampere transformer bank at Columbia substation, serving the north central Washington area, and the McNary-Franklin 230,000 volt transmission line for service to the Pasco-Richland-Walla Walla area.

Work progressed on schedule on a number of important grid additions under way at the beginning of the fiscal year and continuing into the new fiscal year. These include the Big Eddy-Oregon City-Chemawa 230,000-volt transmission line, reinforcing the power supply to the Willamette Valley; the Alvey-Reston-Fairview 230,000-volt transmission line to augment power flows to southwest Oregon; the Big Eddy-Chenoweth-Harvey 115,000-volt circuits to serve the Harvey Machine Co. aluminum plant; the Chief Joseph-Covington 345,000-volt transmission line, reinforcing service to the Puget Sound and Olympic Peninsula areas, and the Chief Joseph-Snohomish 345,000-volt transmission line to supply added service to the Seattle and North Puget Sound area.

New construction begun during the fiscal year included the Redmond-Round Butte 230,000-volt transmission line, to integrate new Co. with the BPA grid on a wheeling basis, and a 250,000 kilovolt-ampere Franklin substation addition for expanded service to the Pasco-Richland-Walla Walla area.

SOUTHWESTERN POWER ADMINISTRATION

Douglas G. Wright, *Administrator*

FOR THE FISCAL YEAR 1957, Southwestern Power Administration received \$1 million in direct appropriations for its operation and maintenance program, and authorization by the Congress making available \$6,400,000 out of receipts, for all costs in connection with the purchase of power and energy, and rentals for the use of transmission facilities. Additional funds in the amount of \$1,052,108 remained available for completion of the Administration's construction program.

Power Resources

The installed capacity and capability in the hydroelectric and steam plants in the integrated system as of June 30, 1957, is shown in the following table.

| Project or plant | River basin | Installed capacity | Capability (June 30, 1957) |
|---|----------------------|--------------------|----------------------------|
| Hydroelectric: | | <i>Kilowatts</i> | <i>Kilowatts</i> |
| Interconnected system: | | | |
| Bull Shoals..... | White..... | 160,000 | 184,000 |
| Denison..... | Red..... | 70,000 | 80,000 |
| Fort Gibson..... | Grand..... | 45,000 | 48,000 |
| Norfolk..... | White..... | 70,000 | 80,000 |
| Tenkiller Ferry..... | Illinois..... | 34,000 | 39,000 |
| Subtotal..... | | 379,000 | 431,000 |
| Isolated plants: | | | |
| Blakely Mountain..... | Ouachita (Red)..... | 75,000 | 75,000 |
| Narrows..... | Little Missouri..... | 17,000 | 17,000 |
| Whitney..... | Brazos..... | 30,000 | 30,000 |
| Subtotal..... | | 122,000 | 122,000 |
| Total hydroelectric..... | | 501,000 | 553,000 |
| Steam: | | | |
| Western Farmers Electric Cooperative..... | | 30,000 | 30,000 |
| Central Electric Power Cooperative..... | | 15,000 | 16,000 |
| N. W. Electric Power Cooperative..... | | 40,000 | 42,000 |
| Total steam..... | | 85,000 | 88,000 |
| Grand total..... | | 586,000 | 641,000 |

This capacity of 501,000 kilowatts will be increased by 100,000 kilowatts when Table Rock project on the White River comes into production, which is presently scheduled for early 1959. A further increase of 180,000 kilowatts will be accomplished by 1961 with completion of the 200,000 kilowatt installation at Table Rock and the addition of 80,000 kilowatts at Bull Shoals.

ENERGY PRODUCTION

Hydroelectric Projects

The adverse water conditions which have existed in the Southwestern Power Administration area since May 1952, although partially alleviated during the first 6 months of 1955, were even more critical during the period July through December 1956. The reservoir system has experienced below median flow for 47 months of the past 5 years. Stream flow conditions improved in February and March 1957. During the 3-month period, April, May, and June 1957, excessively high rainfall with resultant flood runoff not only filled the power pools of the projects but, without exception, produced new maximum pool elevations of record.

| Project and State | Stream | Percent of median flow | | |
|---------------------------------|----------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| | | July 1, 1952 to June 30, 1955 | July 1, 1955 to June 30, 1956 | July 1, 1956 to June 30, 1957 |
| Blakely Mountain, Arkansas..... | Ouachita..... | | | 151 |
| Bull Shoals, Arkansas..... | White..... | 69 | 76 | 186 |
| Denison, Texas-Oklahoma..... | Red..... | 94 | 91 | 229 |
| Fort Gibson, Oklahoma..... | Grand..... | 35 | 44 | 157 |
| Norfolk, Arkansas..... | North Fork..... | 68 | 78 | 157 |
| Tenkiller, Oklahoma..... | Illinois..... | 76 | 44 | 206 |
| Narrows, Arkansas..... | Little Missouri..... | 100 | 101 | 143 |
| Whitney, Texas..... | Brazos..... | | 95 | 299 |
| Total system..... | | 65 | 71 | 179 |

Total stream flow for the fiscal year as shown in the above table was above normal and pools at the end of the year were at exceptionally high elevations. Eighty-five percent of the total volume of flow for the system during the past fiscal year occurred in the last quarter. Secondary energy was generated for 26 days in March and continuously through the last quarter of the year. The total net generation for the year is approximately double the annual primary energy. The energy in excess of primary generation was marketed as secondary and dump. It is expected that secondary energy will be available during the first quarter of the next fiscal year from stored flood waters.

Net hydroelectric generation available to Southwestern Power Administration during the 1957 fiscal year was 1,464,971,500 kilowatt-hours, of which 1,134,739,300 kilowatt-hours were from the interconnected system. The net generation for the past fiscal year and the annual primary energy for each project is given below.

| Project | Net generation (kilowatt-hours) | | |
|------------------------|---------------------------------|---------------------------|---------------------------|
| | Apr. 1, 1957- June 30, 1957 | Percent of fiscal year | 1957 fiscal year total |
| Interconnected system: | | | |
| Bull Shoals..... | 314,564,000 | 48 | 651,472,000 |
| Denison..... | 99,710,000 | 69 | 144,592,000 |
| Fort Gibson..... | 45,767,900 | 63 | 72,589,000 |
| Norfolk..... | 131,520,300 | 64 | 204,285,300 |
| Tenkiller Ferry..... | 39,912,100 | 64 | 61,891,000 |
| Subtotal..... | 631,474,300 | 56 | 1,134,739,300 |
| Isolated plants: | | | |
| Blakely Mountain..... | 145,991,000 | 67 | 219,259,000 |
| Narrows..... | 26,721,740 | 67 | 39,821,200 |
| Whitney..... | 50,028,000 | 70 | 71,152,000 |
| Subtotal..... | 222,740,740 | 67 | 330,232,200 |
| Total..... | 854,215,040 | 58 | 1,464,971,500 |

Steam Plants

The amounts of energy generated by these plants for marketing during fiscal year 1957 are shown in the following table:

| Plant: | Net generation (kilowatt hours) |
|---|------------------------------------|
| Western Farmers Electric Cooperative (Anadarko)..... | 178,176,000 |
| Central Electric Power Cooperative (Chamois)..... | 93,898,000 |
| N. W. Electric Power Cooperative (Missouri City)..... | 236,678,000 |
| Total..... | 508,752,000 |

MARKETING

During the fiscal year 1957 billing period, the Southwestern Power Administration had available for sale a total of 1,966.6 million kilowatt-hours of energy, of which 717.9 million kilowatt-hours represented purchases or withdrawals¹ and 1,248.7 million kilowatt-hours represented hydroelectric generation. Of the total 1,875.9 million kilowatt-hours marketed, after losses, 1,479.8 million kilowatt-hours represented primary and firm energy, while 396.1 million kilowatt-hours represented secondary energy. Energy deliveries to preferred customers amounted to 1,298.9 million kilowatt-hours, equivalent to

¹ Represents generation adjusted to billing periods, without Blakely Mountain contract withdrawals, which are shown under purchases or withdrawals.

104.0 percent of the total hydro-electric energy available for sale and 66.0 percent of the total energy available for sale. At the end of the fiscal year, the Arkansas Power & Light Company was entitled to 217.7 million kilowatt-hours under the aluminum contract, the purchase and delivery of which were deferred in previous years, and the delivery of energy purchased by the Oklahoma utility companies, still deferred, amounted to only 0.7 million kilowatt-hours.

The Arkansas Power & Light Company received into its system under the Blakely Mountain contract 219.3 million kilowatt-hours. The Government withdrew 118.6 million kilowatt-hours, or 100.7 million kilowatt-hours less, from the Arkansas Power & Light system for delivery to other customers.

Revenues from sales by Southwestern Power Administration during the fiscal year billing periods amounted to \$8,771,949. This amount includes sales to preference customers of \$6,755,163, and sales to private utility companies of \$2,016,786.

By the end of the fiscal year, wholesale power and energy generated by the hydroelectric facilities under the marketing jurisdiction of Southwestern Power Administration were being sold to 16 distribution cooperatives, 22 municipalities, 5 private utilities, 5 military installations, and 7 generating and transmission cooperatives.

Power and energy deliveries to preference customers in addition to being made directly over Southwestern Power Administration lines, were made through the facilities of the Texas Power & Light Co., the Southwestern Gas & Electric Co., the Public Service Company of Oklahoma, the Oklahoma Gas & Electric Co., the Central Electric Power Cooperative, the Western Farmers Electric Cooperative, the M. & A. Electric Power Cooperative, the N. W. Electric Power Cooperative, and the KAMO Electric Cooperative.

CONTRACTING

Contract negotiations which were initiated in fiscal year 1956 with five generating and transmission cooperatives were completed in fiscal year 1957. The negotiations with four of these cooperatives resulted in amendments to existing lease and power sales agreements, primarily to delete the Government's option to purchase the G. & T. transmission systems, to include provisions for the settlement of accounts on a net-balance basis, and the addition of provisions for operation and maintenance of the cooperatives' transmission systems by the cooperatives. Negotiations with the Sho-Me Power Corporation of Marshfield, Mo., the fifth of the five G. & T. cooperatives with which negotiations were initiated in fiscal year 1956, resulted in a new temporary agreement being executed to cover the period July 1, 1957, through June 30, 1962.

In addition to the amendments to the G. & T. contracts, new contracts have been executed between Southwestern Power Administration and the Central Electric Power Cooperative, and the Western Farmers Electric Cooperative. These new contracts, which have an effective date of July 1, 1957, supersede and make inoperative the existing lease contract with Central, and both the lease and power contracts with Western.

Major amendments were made to the contracts with the Texas Power & Light Co., and jointly with the Oklahoma Gas & Electric Co., and the Public Service Company of Oklahoma, and an additional contract was entered into with the Southwestern Gas & Electric Co.

Contracts with two additional preference customers, the city of Bentonville, Ark., and the city of Fulton, Mo., were executed during the year. Service to Fulton commenced on May 14, 1957, and service to Bentonville will begin when necessary interconnection is completed.

Contracts for the sale of dump power were executed with several preference customers.

During the year, contract demands and contract obligations were decreased by 11,345 kilowatts. Contracts were also amended to provide for 90 additional points of delivery and to abandon 29 delivery points.

At the end of fiscal year 1957, the sum of the power commitments to all preference customers served by Southwestern Power Administration amounted to 280,195 kilowatts, and were composed of the following:

| | <i>Kilowatts</i> |
|---|------------------|
| Rural Electric Distribution Cooperatives----- | 38, 055 |
| G. & T. cooperatives----- | 198, 800 |
| Military installations----- | 9, 900 |
| Municipalities ----- | 33, 410 |

RATES

During the fiscal year, a repayment and average rate determination study was made, based on Corps of Engineers' 1955 and 1956 cost allocation reports. As a result, four rate schedules were proposed, which include Rate Schedule F-1, a rate schedule for firm power; Rate Schedule P-1, a rate schedule for peaking power; Rate Schedule I-C, a rate schedule for interruptible capacity; and Rate Schedule EE, a rate schedule for excess energy. The new rate schedules were submitted to the Federal Power Commission for confirmation and approval; however, approval had not been received at the end of the fiscal year. Confirmation and approval are expected early in fiscal year 1958.

FEDERAL CIVIL DEFENSE ACTIVITIES

At the request of the departmental defense liaison officer for FCDA Region No. 5, Southwestern Power Administration personnel was appointed to membership on the subcommittees of Training and Office Services. These committees were set up on a continuing basis for the purpose of studying the needs in these areas and recommending remedial action to the Regional FCDA Operating Board.

In response to a call from the local Civil Defense headquarters, 30 Southwestern Power Administration employees volunteered their help in evacuating a large section of Tulsa and in sandbagging the banks of the Arkansas River to avoid further inundation during the 1957 spring flood.

As a result of voluntary services in support of the air defense of the United States by employees of Southwestern Power Administration, the Ground Observer Corps, Air Defense Command, presented its Certificate of Recognition to this Administration at a Public Affairs Forum luncheon in the Tulsa Chamber of Commerce dining room on March 14, 1957.

The Interconnected Systems, Southwest Area, have, through their operating committee, set up procedures which provide for aid and assistance among the companies during disasters or other emergencies for the use of manpower, equipment, and material for restoration of service in the area.

FCDA Delegation No. 4 delegated to the Secretary of the Interior the responsibility to:

Plan a national program, provide technical guidance to the States and direct Federal activities concerned with the emergency restoration of electric utility service to attacked areas and provision of adequate electric utility service to support areas.

This Administration as participant of the Interconnected Systems, Southwest Area, is governed in matters of electric power in civil defense activities by the acting executive director of the Southwest Power Pool who has been appointed to administer the authority under FCDA Delegation No. 4 for Interior Electric Power Area No. 12. In this connection, Southwestern Power Administration furnished personnel for the FCDA 1956 alert to assist the acting executive director of the Southwest Power Pool.

SOUTHWEST FIELD COMMITTEE

Representation on the Southwest Field Committee during fiscal year 1957 included active participation in programs and problems regarding water compacts, watershed planning under Public Law 566,

new and pending legislation, preparation of the regional program report and civil defense activities.

The changing water situation in the Southwest has resulted in an adjustment of long-range programs to recognize present conditions and to expedite the consideration of water and power projects required to satisfy the most pressing needs.

We are cooperating in the Committee's program to meet the Department's obligation to keep the planning of water resource developments abreast of other developments in the region.


ARKANSAS-WHITE-RED BASINS INTERAGENCY COMMITTEE

Southwestern Power Administration has continued to participate in all meetings of the Arkansas-White-Red River Basins Interagency Committee during the fiscal year 1957.

With the Department of Agriculture as the chairman agency for fiscal year 1958, this Administration has expressed its interest to the incoming chairman, of our future participation and cooperation with this group in its program to provide, at the regional level, improvement of coordination of activities in the field of water and related land resources; providing means by which interagency problems in the field may be resolved; suggesting to the Interagency Committee on Water Resources and the States, changes in law or policy which would promote these purposes; and collecting and interpreting basic data.

SOUTHEASTERN POWER ADMINISTRATION

Chas. W. Leavy, *Administrator*



THE HYDROELECTRIC output marketed by the Southeastern Power Administration in fiscal year 1957 consisted of 988,000 kilowatts of capacity (with peak generation of 1,202,050 kilowatts) and 2,545,830,184 kilowatt-hours of energy. It was sold to 45 public bodies, 68 rural electric cooperatives, 1 Federal agency, and 6 privately owned utilities. The sales earned \$13,644,211.77, an increase of \$2,199,653.44 over earnings of the previous year, and brought revenues earned in all years to a total of \$56,816,472.73.

The output was generated at ten Corps of Engineers projects. They were the Wolf Creek, Dale Hollow, Center Hill, and Old Hickory projects in Kentucky and Tennessee, the Allatoona and Buford projects in Georgia, the Clark Hill project in Georgia and South Carolina, the Jim Woodruff project in Florida, the John H. Kerr project in Virginia, and the Philpott project in Virginia. The installed generating capacity of 1,031,000 kilowatts at the beginning of the fiscal year was increased to 1,126,000 kilowatts during the year by installations at the Old Hickory, Buford and Jim Woodruff projects. Installation of additional generating units by the Corps of Engineers continued at the Old Hickory and Buford projects and construction by the Corps continued on three other projects (Cheatham in Tennessee, Fort Gaines in Georgia and Alabama and Hartwell in Georgia and South Carolina). The installations and construction under way will add 485,000 kilowatts of installed capacity.

The combined output of Wolf Creek, Center Hill, and Dale Hollow projects was sold to the Tennessee Valley Authority under a long-term contract and the output of the one unit installed at the Old Hickory project was sold to the Authority under a short-term, interim agreement. All power generated at the Allatoona project

was sold under a long-term contract to the Georgia Power Co. All of the Philpott project output was sold to Appalachian Electric Power Co. under temporary arrangements pending the conclusion of negotiations for long-term sales. Part of the Clark Hill project output was sold under long-term contracts to two public bodies in South Carolina, and the one-half of the output of the Clark Hill project to be marketed in Georgia was sold under long-term contracts to Georgia Power Co. and 77 public bodies and cooperatives in Georgia. Two-thirds of the Kerr project's output was sold under long-term contracts to the Virginia Electric & Power Co., and to 17 cooperatives in Virginia and North Carolina and the remainder was sold under long-term contracts to Carolina Power & Light Co. and 16 public bodies and cooperatives in North Carolina.

The Congress appropriated \$256,000 for headquarters operation and maintenance, and \$1,669,000 for the purchase of firming energy and the payment of wheeling fees. Southeastern's working force numbered 34 employees at the beginning of the fiscal year and 35 employees when the year ended.

DEFENSE ELECTRIC POWER FUNCTIONS



ACTIVITIES in the defense electric power field are concerned with planning to assure an adequate power supply for the Nation under mobilization conditions. The Assistant Secretary—Water and Power Development—exercises direct supervision over these activities. The administration of electric power functions is vested in the Secretary of the Interior under the Defense Production Act, Executive orders, and delegations from the Office of Defense Mobilization and the Federal Civil Defense Administration.

In carrying out the present electric power delegations of the Office of Defense Mobilization and the Federal Civil Defense Administration, Interior is establishing field organizations in sixteen power areas throughout the Nation to cooperate with ODM and FCDA in assuring an adequate supply of electric power to essential services in the event of a national emergency.

A group composed of representatives from ODM, Departments of Commerce, Defense, and Interior, and the Federal Power Commission has completed a study evaluating the power situation in the Niagara area in the event of an enemy attack. This same group is now proceeding with a similar study of the Pacific Northwest.

A departmental representative served on a task group which reviewed and revised under new criteria the Industrial Evaluation Board analysis of electric power generating stations and substations throughout the entire United States.

Evaluation of data as to the production capacity of the electric power industry reveals little change in the scheduled rate of increase of generating capability in the United States from that of a year previous.

December peak capability, peak loads, and gross reserves as actually occurred in 1955 and 1956, and as forecast for 1957 through 1960, on the basis of median hydro conditions, are shown for the country as a whole.

| Year | December capabilities (millions of kilowatts) | December peak loads (millions of kilowatts) | Gross reserves (percent of loads) |
|---------------------|--|--|--------------------------------------|
| 1955 actual..... | 116.1 | 97.9 | 18.6 |
| 1956 actual..... | 122.6 | 102.4 | 19.7 |
| 1957 estimated..... | 131.0 | 113.4 | 15.5 |
| 1958 estimated..... | 148.0 | 123.1 | 20.2 |
| 1959 estimated..... | 160.7 | 132.2 | 21.5 |
| 1960 estimated..... | 171.4 | 141.5 | 21.1 |

Although, in general, gross reserves are adequate on a national basis and are estimated to increase annually from 1957 through 1960, reserves are estimated to fall below 15 percent in Federal Power Commission Regions I in 1957 and 1958; II in 1957; III in 1957, 1959, and 1960; and VII in 1957 through 1960.

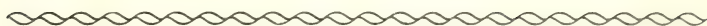
Under median hydro conditions it is estimated power will be available in all regions to supply all load requirements. Under adverse hydro conditions these same conditions prevail except in Region VII, the Pacific Northwest, where power to interruptible loads might have to be curtailed.

The Office of the Assistant Secretary—Water and Power Development—has been the allotting agency for a program which provided allotments and priority assistance on materials and equipment for construction of certain facilities including 89 generating units with nameplate ratings totaling 10,721,000 kilowatts to furnish interim, firm, and backup power to Atomic Energy Commission installations. The program which started in 1953, has been completed with the last unit going into service June 27, 1957.

Expansion Goals No. 55 (electric power) and No. 225 (power facilities for military, atomic energy, and defense related needs) have been closed. Under these two goals certificates of necessity for rapid tax amortization issued by ODM are related to an increase in the Nation's electric power capacity of approximately 35.5 million kilowatts.

OFFICE OF SALINE WATER

David S. Jenkins, *Director*



AMONG ALL OF THE natural resources, water is perhaps the most essential to human life and economic activity. As with other resources, potable water is not distributed equally among the various areas of our country. Consumption of water, like that of various other resources, has increased out of proportion to the increase in our population and some areas in this country are reaching the limit of their fresh water supplies. Because of the increasing demand for fresh water, our effective fresh water base is being reduced in a number of areas, by salt water intrusion into fresh water supplies by salt accumulation due to reuse and other causes, and by a lowering of the water table due to excessive withdrawals.

The saline water conversion program in seeking one answer to the growing problem of adequate water supplies, works toward the development of this vital natural resource. Very significant supplies of brackish underground and surface water exist in inland areas and an inexhaustible supply of ocean water is available at our shores. Thus, this Nation's water resource base can be developed and extended through saline water conversion.

Recognizing the needs and potential benefits to be gained from large scale purification of saline waters, the Congress of the United States authorized a research and development program directed toward the development of economically feasible processes for producing fresh water from sea and brackish waters, by enactment of Public Laws 448 (1952) and 111 (1955).

Progress toward the solution of this problem is being made and several desalinization processes under investigation look promising. Investigations in the field of distillation have been continued during the past 12 months and two different prototypes involving vapor compression and multiple-effect distillation, will be field-tested on live sea water during fiscal year 1958. Fabrication of the Badger-Hickman vapor compression unit having design capacity of 25,000 gallons per

day has been completed and the unit has been shop-tested. The distillation cycle proposed by Mr. W. L. Badger utilizes long tube vertical evaporators in a multiple-effect distillation. The economy of this process, among other things, depends upon scale-free operation and a test unit is being assembled by Mr. Badger and the Whiting Corp. It will be tested on sea water for the purpose of developing scale prevention techniques. An engineering design study of a process involving low temperature vacuum flash distillation, often referred to as the low thermal difference system, is being made by the Griscom-Russell Co. A preliminary cost analysis study of certain nuclear power reactors and distillation equipment is being conducted by Fluor Corp. This investigation is being closely coordinated with the Atomic Energy Commission which is assisting in the development of the technical scope of the study.

Solar distillation requires a successful solution to the construction and maintenance costs of characteristically extensive solar distillation units, in contrast to thermal distillation where a more critical factor is the design of equipment to minimize energy costs. Research has continued during the year aimed at reducing construction costs of solar stills, improving materials and increasing production through a multiple-effect cycle and other means.

Research investigations have demonstrated that demineralization of saline waters is possible by several processes utilizing membranes. These processes consist of electrodialysis, reverse osmosis, osmionics, and transport depletion. One of the limiting factors in the use of these processes has been the membranes themselves. Consequently, research aimed at improving certain characteristics of the membranes was continued during the past year by the National Bureau of Standards, Polytechnic Institute of Brooklyn, and the University of Florida. Several industrial companies in the United States have developed improved ion-permeable membranes and their researches are continuing.

Membrane durability tests on an Ionics, Inc., demineralizer are being conducted at the Bureau of Reclamation Laboratories in Denver, Colo., and in addition a membrane evaluation program is underway at this facility. Informal cooperation with the Central Technical Institute (T. N. O.), The Hague, Netherlands, on electrodialysis was continued and the possibility of obtaining an experimental T. N. O. unit for testing in the Reclamation Laboratories is being explored.

An exploratory investigation at the University of Florida on the mechanism of water and ion flow through osmotic membranes was completed during the past year. The information obtained will materially assist the development of improved osmotic membranes for use in the reverse osmosis desalinization process.

The design, construction, and testing of a practical osmionic unit (an osmotically powered process developed by Dr. G. W. Murphy) was continued at Southern Research Institute. A small model designed to demineralize brackish water at the rate of 240 gallons per day will be tested toward the latter part of 1957.

Several investigations in the field of freezing were carried on. The Applied Science Laboratories continued their studies on ice crystal formation and the investigation being conducted by Battelle Memorial Institute on zone purification was extended. This latter study has progressed to the point where an engineering design study and an estimate of the potential economic feasibility of the process can soon be made. The investigation of a potentially promising process involving freezing by self-evaporation was undertaken by the Carrier Corp. Rapid progress is being made in the development of this process and preliminary cost analyses show that the process is economically promising, and a laboratory experimental unit is in operation.

The investigation of a solvent extraction process was continued by Texas A. & M. Research Foundation and an exploratory survey on the possibility of utilizing the principle of kidney function in the demineralization of saline water was initiated by Resources Research.


Plans for the first comprehensive Saline Water Conversion Symposium to be held in Washington, D. C., late in 1957, were well advanced, the details of which were handled by the National Academy of Sciences.

During the coming year field-testing of three prototype distillation units will be initiated and both fundamental and applied research on the problem will be continued.

Office of the Assistant Secretary

Mineral Resources

Felix Edgar Wormser, *Assistant Secretary*



THE ASSISTANT SECRETARY for Mineral Resources discharges the responsibilities of the Secretary of the Interior with respect to the Department's programs in the field of the development and utilization of minerals and metals, including mineral fuels. He exercises supervision over the Geological Survey, the Bureau of Mines, the Defense Minerals Exploration Administration, the Office of Oil and Gas, the Office of Minerals Mobilization, and the Division of Geography.

The Assistant Secretary serves as the principal spokesman for the Department of the Interior in the field of mineral affairs at the policymaking level within the Federal Government. He participates in meetings of the Council on Foreign Economics Policy as the Department's liaison representative, and sits frequently with the Defense Mobilization Board as problems involving minerals and fuels are considered. He is the Department's representative on the Titanium Advisory Committee.

The office coordinates the Department's representation on the interdepartmental advisory committees that the Department of Commerce utilizes in carrying out its responsibilities under the Export Control Act of 1949. Items in short supply requiring particular attention included iron and steel scrap, copper, nickel, and selenium. Substantial progress was made during the year toward relaxation, and where possible elimination of export controls.

In addition to the foregoing responsibilities, the Office of the Assistant Secretary, Mineral Resources, is the principal point of contact between the Federal Government and the mineral industries. The Assistant Secretary met frequently with representatives of the industry.

In connection with his responsibilities under the voluntary agreement relating to foreign petroleum supply, the Assistant Secretary for Mineral Resources supervised the development and implementation of the plan of action during the Suez crisis. Under the plan, domestic companies cooperatively took steps necessary to prevent, eliminate, or alleviate petroleum shortages which would otherwise

have resulted from the interruptions in Middle East petroleum movements subsequent to the closing of the Suez Canal. The Assistant Secretary was active in the establishment of the Middle East Emergency Committee and attended meetings of that Committee. In appearances before congressional committees he reviewed the actions taken by the Middle East Emergency Committee and its associated foreign committees in implementing the "Oil Lift" to Europe.

The Office of the Assistant Secretary, Mineral Resources, completed work during the fiscal year on the development of proposals for a long-range minerals program. On June 4, 1957, Secretary Fred A. Seaton presented the program to the Congress. The program contained recommendations calling for the intensification and acceleration on the part of the Bureau of Mines and the Geological Survey of research and of those activities which must precede mining. It recommended that continued attention be given to the tax laws and to the laws governing mining and mineral leasing on the public lands. It proposed a program of financial assistance to exploration and called for special assistance to particular segments of the mining industry. Legislative proposals were submitted which, if passed, will place in effect important portions of the program.

The office aided in the preparation of testimony in connection with hearings on the long-range minerals program and on special legislation relating to lead and zinc.

The Office of the Assistant Secretary continued to supply information and advice to the Director of the Office of Defense Mobilization concerning the administration of the Government's long-range strategic stockpiling program. The Office also worked closely with the Office of Defense Mobilization and the Department of Agriculture regarding the acquisition of strategic and critical materials for the supplemental stockpile by barter. The Office was primarily responsible for the administration of the Domestic Tungsten, Asbestos, Fluorspar, and Columbium-Tantalum Production and Purchase Act of 1956 (Public Law 733, 84th Cong.). Funds allocated for purchases of tungsten and asbestos were exhausted prior to the end of the fiscal year. The Office participated extensively in the development of requests for additional appropriations to carry out the terms of Public Law 733 with respect to these commodities. Adequate funds were available for purchase of fluorspar and columbium-tantalum.

The Office continued to participate in the Department's program of post-attack planning. Staff members from the Office were active in planning and implementation of Operation Alert, 1956.

The Office also initiated and coordinated studies and analyses of tariffs on several minerals and metals as a basis for developing the Department's position with respect to proposed tariff legislation, and reviewed proposals for legislation dealing with minerals. The Office was responsible for preparation and presentation of testimony before congressional committees.

A detailed review of the helium supply and requirement situation was initiated in cooperation with defense agencies—the principal consumers of this commodity.

GEOLOGICAL SURVEY

Thomas B. Nolan, *Director*



THERE HAVE BEEN no changes during the past fiscal year in the primary responsibilities and duties of the Geological Survey—to determine the geologic conditions and appraise the Nation's mineral resource potential; to classify the public lands and supervise oil, gas, and mineral leases on the public lands; to map the surface features of the Nation; and to evaluate the availability and quality of United States water supplies. But some changes have been made in the Survey's organizational makeup and the tools with which it seeks to accomplish its assigned mission.

Reorganization of the Water Resources Division has been accomplished to serve the public better at a time when increasing workloads have stretched capacity to the limit. The revised structure is designed to improve program planning and to provide well-integrated operations within the division, and to improve facilities for increasingly important general hydrologic studies.

In topographic mapping, fieldmen made increased use of helicopters for transportation to remote or high areas. New higher powered helicopters enabled safe operations on 17 peaks more than 12,000 feet high, including Mount Whitney and Mount Rainier.

Under the guidance of mathematicians and earth scientists a modern electronic computer has simplified and speeded up several important administrative and scientific tasks including current payroll procedures, and has made it possible to accomplish in a matter of hours, research tasks in geology, water resources, and topography that formerly required the services of many technical persons working full time for weeks or months.

The following report summarizes technical and publications activities of the Survey during fiscal 1957, the 78th such report since the Bureau was established in 1879. It shows how Survey engineers and scientists have shared in promoting continued national economic security.

GEOLOGIC DIVISION

During fiscal year 1957 the Geologic Division continued its study of the geology of the United States and of the mineral resources of the Nation.

Survey geologists continued to provide technical data and evaluation in the programs of the Defense Minerals Exploration Administration, the Office of Minerals Mobilization, and the General Services Administration; geologic investigations of mineral resources in Latin America, Asia, and Africa were made for the International Cooperation Administration; a broad program of research in fissionable materials was continued for the Atomic Energy Commission; investigations of terrain conditions of selected areas were also continued for the Armed Forces; and, as in past years, Survey geologists served as advisers and consultants to the National Science Foundation, the Office of Defense Mobilization, and the Department of Defense. Many of the projects carried on by the Geological Survey are in cooperation with State agencies.

Mineral Deposits Investigations

Continued progress was made in mapping and appraising the Nation's mineral resources, and in obtaining and publishing data on the geologic setting of mineral deposits and the factors controlling their deposition and localization. Progress was made on the development of techniques useful in the search for additional deposits.

Fieldwork progressed on 67 projects, 35 others were in the report writing stage, and 15 were brought to completion. Laboratory support was accorded each, as appropriate, and in many of the field activities the geological investigations were supplemented by geophysical and geochemical work. Also, 24 laboratory research projects were active. Twenty-six of these projects were in cooperation with States. In addition, on behalf of the Atomic Energy Commission, 66 field projects were carried on, 21 of which were in the report writing stage. Another 39 projects involved laboratory research.

A total of 28 bulletins and professional papers and 34 maps were published in the regular Geological Survey series, 34 maps and explanatory texts were released through open files and large numbers of shorter contributions were made by release of data through State and journal publications.

More than 4,800 mineralogical determinations and some 280 rock analyses were made by the mineral and chemical laboratories, and literally thousands of special analyses involving spectrographic and X-ray diffraction techniques, plus some 230 mechanical analyses and



FIGURE 13.—Survey geologist selecting a rock sample for analysis: Jackson Hole, Wyo.

130 radiometric age determinations were made by the laboratories in support of the geologic mapping and other field activities.

Geochemical Exploration

During the year methods were developed by which the dispersal pattern of copper, mercury, and selenium may be traced in soils and rocks. A low-cost, compact, mobile, wet-chemical laboratory was constructed and equipped for the determination of 21 different elements. Studies in the ratio of oxygen-18 to oxygen-16 isotopes in hydrothermally altered rocks continued with promising results. It now seems fairly clear that variations in the isotopes of oxygen can be used to distinguish certain minerals formed by hydrothermal processes from the same minerals formed by marine sedimentary processes, and that the oxygen isotopic ratios in certain minerals formed under hydrothermal conditions vary with the distance from the conduits through which the heated solutions passed. These findings provide important new approaches to the search for mineral deposits.

Results of a study of the oxidized zinc ores of Colorado, Utah, Nevada, and California show that there are large reserves of low-grade oxidized ores in many places in these regions. A structural contour map of the Metaline lead-zinc district, Washington, was pre-

pared and placed in open file. A report was published on Central Cochise County, Ariz., an area that includes a number of copper deposits. Results of the work show that the intrusive rocks in which the copper occurs are not of a common age.

Through the use of a curved X-ray spectrometer, methods were devised for the determination of thorium and uranium in zircon crystals to aid in the determination of the ratio of hafnium to zirconium in the crystal. By these methods it is now possible to detect as little as 5 micrograms of thorium. The curved X-ray spectrometer was designed by Survey scientists for use in detecting and analyzing very small crystals and minute quantities of mineral substances in the polished surfaces of some ores.

Work continued on resource studies of such commodities as niobium-tantalum, selenium, chromite, silica, titanium, graphite, potash, beryllium, magnesia, gypsum, manganese, platinum, tungsten and barite. Resource reports were published on fluorspar and gem stones of the United States. At the request of the Office of Minerals Mobilization, Survey commodity geologists participated in the preparation of detailed mineral materials surveys and summary reports on about seven commodities and a continuing review was maintained for a number of others.

Using two planes equipped for airborne geophysical work, the Geological Survey's DC-3 and a C-47 on loan from the Air Force, aeromagnetic or radioactivity surveys were made of large areas in the United States. Detailed aeromagnetic surveys were made in eastern Pennsylvania, northern Wisconsin, New Hampshire and Maine in cooperation with the respective States.

Gravity surveys were continued on the ground in western Colorado, eastern Utah, eastern California (Owens, Long, Panamint, and Death Valleys, and the Mojave desert) and the Cuyuna and Mesabi iron districts of Minnesota.

The Geological Survey's program on behalf of the Atomic Energy Commission is now oriented toward long-range, fundamental studies of the geologic processes that govern the emplacement of uranium deposits. These studies involve systematic geologic mapping and research with supporting geophysical and geochemical investigations to obtain data on the size, shape, and mineralogy of potential reserves and resources of radioactive materials.

In the Grants-Laguna area, New Mexico, detailed geologic work tends to confirm the concept of zoned ore deposits which, in this area, may save many feet of unnecessary exploratory drilling in the search for ore bodies. Studies in the Gas Hills-Hiland-Clarkson Hill area of Wyoming indicate that at least some of the uranium deposits are very young and are related to post-Miocene to Pleistocene tilting to the south. In the Texas coastal plain, airborne radioactivity and

magnetic surveys in conjunction with geologic mapping have developed valuable data on the correlation of airborne radioactivity and geophysical data with the general geology of the area.

A program of systematic geologic mapping and minerals appraisal continued in cooperation with the Puerto Rico Economic Development Administration. Field mapping is nearly completed in six 7½-minute quadrangles and about half done on 3 others.

Mineral Fuels Investigations

The Geological Survey continued its program of mapping and research in potential oil- and gas-producing areas throughout the Nation to provide background information needed in the formulation of sound exploration programs. During fiscal year 1957 surface and subsurface geologic mapping, and stratigraphic investigations were conducted in 22 petroleum-producing or potentially producing States. In three States the work was done cooperatively with the State. A geophysical (gravity) map of the northwestern part of the Los Angeles basin, California, was completed and published. Study of a set of samples from a deep test well in southwestern Mississippi has indicated a structural uplift of considerable magnitude. This feature extends the off-shore oil possibilities eastward from Louisiana. A map of Nebraska showing test wells for oil and gas, anticlines and basins, oil and gas fields, pipelines, and the areal distribution of pre-Pennsylvanian rocks is being compiled for publication. Subsurface investigations were started in eastern Nebraska.

A folio of paleotectonic maps and charts was published showing the distribution, character, and variations in the strata of the Jurassic system of the United States. Work on a similar folio covering the Triassic system is near completion. These maps, which synthesize a vast amount of data that otherwise are widely scattered, represent a new departure in the presentation of stratigraphic data on a nationwide scale. The initial volume has proved of especial interest to the oil industry.

Geologic investigations were carried on in eleven coal-producing states: Alabama, Arkansas, Colorado, Kentucky, Maryland, Montana, New Mexico, Pennsylvania, Tennessee, Utah, and Wyoming. Appraisals of coal reserves were continued in Alabama, Arkansas, Colorado, eastern Kentucky, and western Pennsylvania. Revision of the coal map of the United States is nearly complete.

A total of 7 bulletins and professional papers and 11 maps were published in fiscal year 1957 in the regular Geological Survey series, summarizing results of mineral fuels investigations. In addition, three reports were released through open file, and 26 reports were released through State and journal publications.

General Service Geology

A primary purpose of general service geology is to provide the geologic data needed in planning the construction of civil engineering works and the development of water and land utilization programs. Projects are designed, therefore, to yield geologic data on the distribution, character, and depth of foundation rock; on sources of construction materials; on feasibility of alternate routes of highways, aqueducts, or tunnels; on the suitability of terrain for airfields or other large installations; on the geologic aspects of soils; and on areas of potential landslides. Evaluations of these kinds are based on data gained from systematic geologic mapping and from research in geologic processes. Field work was carried forward on 43 projects, 8 of which were brought to completion; reports were being prepared on 13 others.

During the fiscal year 8 geologic quadrangle maps and accompanying reports, 3 miscellaneous geologic investigations maps, and 1 bulletin were published, 12 technical papers appeared in professional journals, and 12 reports were made available to the public in open-file depositories. Twelve geologic quadrangle maps, 4 professional papers, 1 bulletin, and 2 miscellaneous geologic investigations maps are in the process of preparation for publication by the Survey; 13 reports are being prepared for publication in technical journals.

Field work was completed at San Francisco, Calif., and a report on the results of the engineering geology study is near completion. Mapping progressed in the Seattle, Wash., Denver, Colo., and Los Angeles, Calif., areas. Reports on the Omaha, Nebr., and Portland, Oreg., areas were near completion.

Geologic mapping of both bedrock and surficial deposits continued in cooperation with the States of Massachusetts and Rhode Island, and the State of Connecticut, with emphasis on providing geologic background data needed in the solution of engineering problems. A mapping project in the upper Green River Valley, Utah, is near completion. Mapping continued along Lower Snake River, Wash., in the Great Falls region, Montana, and in the Upper South Platte, along the route of the Denver water diversion tunnel.

Studies of the landslides areas along the shoreline of Fort Randall, S. Dak., reservoir were completed. Studies were continued on sea-cliff erosion along the New England Coast. Laboratory tests were made of samples collected from critical parts of the areas mapped to provide information required by planning and design engineers on the physical character of the materials involved.

Work continued on the revision of the geologic maps of the States of Arizona and New Mexico. Work also continued on the preparation

of a geologic map of the State of Oregon, and a preliminary map of the western part of the State was compiled for publication.

Alaskan Mineral Resources

A large portion of the overall effort during the year was devoted to preparation of reports on work previously done in Alaska. The Geological Survey published 9 bulletins and professional papers and 8 maps; 12 reports were released to open files; and 6 reports were printed by technical journals.

Reports were completed or nearing completion on high grade limestone deposits in the area of Hecata and Tuxekan Islands, southeastern Alaska; on reconnaissance investigations in the Glacier Bay area; on the large ilmenite-bearing layered basic intrusive body in the Fairweather Range; on reconnaissance examination of ilmenite-bearing beach sands near Lituya Bay; on the tin deposits of the Lost River mine; on the antimony deposits of the Stampede mine; and on the nickel deposits of the Funtier Bay area. Photogeologic mapping at a scale of 1:250,000 was accomplished in the Iditarod, Talkeetna Mountains and Dixon Entrance quadrangles and in areas near Sitka and Juneau, Alaska, and Prince William Sound. Systematic geologic mapping was carried out in the Tofty-Eureka tin-gold placer district and in the vicinity of Nome. The first phase of a plan to test the application of hydrochemical and other geochemical prospecting techniques to Alaskan situations was started.

A general report on the geology of Alaska as related to petroleum possibilities was near completion. Compilation continued on the results of stratigraphic and structural studies of the Nelchina area and limited field studies were renewed. Oil and gas maps of the Yakataga and Malaspina districts of the Gulf of Alaska Tertiary Province were published. Progress was made toward completion of reports on Naval Petroleum Reserve No. 4 concerning investigations carried on in cooperation with the Navy during the period 1945-53. Field studies of the structural and stratigraphic characteristics of the Cretaceous rocks of the south-central part of Koyukuk Basin were completed and work on a report was started. These investigations are proving of considerable economic interest as much of this area has been leased for petroleum exploration.

Field investigation of Alaskan coal deposits were carried on in the Matanuska and Nenana coal fields. The work in the Matanuska area proved that the coal-bearing formation underlies a larger area than previously believed. Progress was made on a comprehensive report on the Nenana coal field and on a summary report on the coal resources of Alaska.

The engineering geology program in Alaska continued on a modest scale. Reports were prepared on surficial and engineering geology in the Nenana-Rex area, the Katalla area, the Susitna-Maclaren area and in small areas near Fairbanks.

National Minerals Policy

In accordance with the President's national minerals policy, several projects were started during the year that will contribute to a better understanding of the geochemical, geophysical, and geologic processes involved in the formation and localization of ore. Work was begun on the thermodynamic properties of ore and of rock-forming minerals, on the physical properties of earth materials, on the distribution of minor elements in intrusive rocks, on the environment and geochemistry of ore-forming solutions, and on the distribution of stable isotopes. Much of the effort this first year was spent in establishing laboratory facilities, testing procedures and calibrating instruments. In addition, research was begun on new and modified geophysical methods, on the use of color photography in photogeology and on hydrogeochemical prospecting.

In cooperation with the National Park Service, plans were completed and construction begun on a geochemical laboratory at the Hawaiian Volcano Observatory on the rim of Kilauea in Hawaii. The laboratory will provide facilities for making systematic studies of the geochemical aspects of the volcanic gases and other products, as a research project on chemical volcanology in the national minerals policy program.

Geologic mapping was started in 10 places in the United States and one in southeastern Alaska. Mapping effort was concentrated on geologically little known areas of Maine, Washington, and Alaska; on starting a geologic cross-section through the potential mineral-producing areas of the Southern Appalachians; and on detailed mapping in Montana to help us understand important geologic structures and their relation to the ore-bearing areas. Each of the mapping parties was given geochemical, geophysical, and paleontological support as required.

Military Geology

Geologic investigations on rock types, soil, vegetation and water resources were continued to provide technical advice to the Corps of Engineers, United States Army, and other agencies of the Armed Forces. During the year 42 comprehensive studies of foreign regions and 30 technical reports and maps were prepared by geologists, bot-

anists, soil scientists, and other technicians in the Washington office. In addition, numerous advisory consultations, briefings, and lectures were provided to military personnel on the military aspects of the geology in foreign, territorial, and domestic areas.

Technical assistance to the Corps of Engineers in Germany and Japan was continued. A team of specialists (geologists and soil scientists) assigned to headquarters in Heidelberg directed and instructed military technicians in the preparation of special-purpose terrain maps.

Field studies during the year were continued in the western Pacific and Alaska. In the Pacific, field surveys were completed on the islands of Ishigaki and Miyako in the Ryukyu Islands. A soils survey was completed on Yap, Caroline Islands, and an investigation of the water resources was completed for Truk, Caroline Islands. Military geology reports for Palau and the northern Marshall Islands were published, and preparation for publication continued on reports for Truk, Okinawa, Tinian, Guam, Yap, Pagan, Ishigaki, and Miyako. The Engineer, United States Army Forces Far East, requested numerous engineering geology consultations, primarily on the evaluation and discovery of water resources for military use in Korea, Okinawa, and Taiwan. Aid was given to the Navy on problems encountered in the Marshall Islands.

The program of field surveys of geologic and associated terrain and permafrost conditions in Alaska continued for the eleventh year. Field reconnaissances were continued in the Copper River Basin. New projects were started in the areas of Johnson River and Thompson Pass. Comprehensive military and scientific reports were under way on 10 areas previously investigated. The Survey, in cooperation with the terrain and permafrost program of the Corps of Engineers, United States Army, and supplementing it, carried on geothermal studies in the vicinity of Glenallen in the Copper River Basin and in the Fort Greeley area. Geologic mapping was completed in the Mount Hoyer D-3 quadrangle. The compilation of a surficial deposits map of Alaska was begun and work continued on compilation of a glacial map of Alaska.

In addition to furnishing advice and studies to the Corps of Engineers, the Survey made field studies on problems in the Arctic, primarily Greenland, for the Air Force.

Foreign Geology

Technical assistance in geology and mineral resource investigations was extended to 17 countries in Latin America, Africa, Asia, and the Far East under the auspices of the International Cooperation Ad-

ministration, United States Department of State. Cooperative minerals studies were continued with counterpart scientific agencies in Brazil, Chile, Peru, Mexico, India, Libya, China, Indonesia, and the Philippines. Cooperative studies were begun in Pakistan, Iran, and Thailand. Joint mineral studies were completed in Cuba, Israel, and Egypt. Advisory services in geology were extended to the Governments of Ecuador and Costa Rica. Two specialists in geological education began a 3-month study of facilities at the University of Chile toward the establishment of a new school of geology. Specialists in engineering geology and ore deposits completed 4-month seminars at the Geological Survey of India.

Thirty-two participants from 18 countries, under the sponsorship of the International Cooperation Administration and the United Nations, received training in the Survey's domestic program.

Survey personnel were giving training to more than 100 nationals of countries in which long-term projects are being conducted. In addition, nationals of Afghanistan, Bolivia, India, Pakistan, Philippines, Spain, Taiwan, Thailand, and Turkey received training in the United States.

Library

The 1952-53, the 1954, and the 1940-49 cumulative volumes of the Bibliography of North American Geology have been published and the 1955 volume is in press.

Library use and activity in the Geological Survey Library in Washington and its branches in Denver and Menlo Park are summarized as follows:

| Activity | Washington | Denver | Menlo Park |
|--|------------|--------|------------|
| Text accessions..... | 24,256 | 20,883 | 14,594 |
| Map accessions..... | 2,380 | 1,519 | 3,280 |
| Loans to Survey personnel..... | 44,779 | 12,455 | 3,556 |
| Loans to other libraries..... | 6,040 | 784 | 550 |
| Items borrowed from other libraries..... | 7,391 | 1,513 | 500 |
| Items used within library..... | 102,105 | 42,351 | 12,948 |

WATER RESOURCES DIVISION

The Water Resources Division is responsible for determining, appraising, and describing surface and underground water resources and water problems of the Nation. The tremendous past and prospective growth of the Nation has sharpened the focus of attention on water problems of the whole country, as well as on local areas

and regions. The recurrence of disastrous floods and droughts has increased public awareness of the importance of water problems.

Water resources investigations include the systematic collection, analysis, and publication of hydrologic and related geologic data; appraisal of water resources of specific areas; determination of water requirements for industrial, domestic, and agricultural uses; and research and development to improve techniques and the scientific basis of investigations.

Three sources of funds are available for financing water-resources investigations:

1. Direct appropriation.
2. Funds provided by States and municipalities to be matched by the Federal funds for investigations having mutual interest.
3. Funds transferred from other Federal agencies for work performed at their request.

Federal-State cooperative investigations began in 1895 and this type of program has grown steadily, now constituting about 60 per cent of the Division's total program. Funds made available by States and municipalities in 1957 for cooperative studies are shown in the following table:

| | | | |
|--------------------|------------|---------------------|-------------|
| Alabama..... | \$167, 800 | Nevada..... | \$31, 595 |
| Arizona..... | 127, 414 | New Hampshire..... | 20, 881 |
| Arkansas..... | 54, 079 | New Jersey..... | 132, 282 |
| California..... | 430, 141 | New Mexico..... | 193, 296 |
| Colorado..... | 111, 786 | New York..... | 263, 696 |
| Connecticut..... | 36, 600 | North Carolina..... | 123, 079 |
| Delaware..... | 29, 662 | North Dakota..... | 36, 418 |
| Florida..... | 201, 362 | Ohio..... | 153, 051 |
| Guam..... | 20, 090 | Oklahoma..... | 116, 527 |
| Hawaii..... | 107, 936 | Oregon..... | 70, 189 |
| Georgia..... | 104, 849 | Pennsylvania..... | 175, 174 |
| Idaho..... | 63, 026 | Rhode Island..... | 24, 742 |
| Illinois..... | 72, 637 | Samoa..... | 1, 738 |
| Indiana..... | 152, 585 | South Carolina..... | 36, 413 |
| Iowa..... | 60, 603 | South Dakota..... | 27, 569 |
| Kansas..... | 91, 556 | Tennessee..... | 89, 827 |
| Kentucky..... | 144, 745 | Texas..... | 369, 883 |
| Louisiana..... | 166, 675 | Utah..... | 114, 909 |
| Maine..... | 12, 594 | Vermont..... | 8, 560 |
| Maryland..... | 61, 581 | Virginia..... | 70, 627 |
| Massachusetts..... | 49, 582 | Washington..... | 129, 793 |
| Michigan..... | 92, 475 | West Virginia..... | 36, 220 |
| Minnesota..... | 126, 879 | Wisconsin..... | 50, 460 |
| Mississippi..... | 61, 424 | Wyoming..... | 65, 736 |
| Missouri..... | 40, 061 | | |
| Montana..... | 57, 096 | Total..... | 5, 069, 515 |
| Nebraska..... | 81, 972 | | |



FIGURE 14.—Survey engineer lowers a current meter with 300-pound sounding weight attached, in the course of gathering streamflow data on the Atchafalaya River.

Surface Water Investigations

Surface-water records were obtained at 6,900 sites in the continental United States and in Alaska, Hawaii, and Guam during the fiscal year 1957. The records include 4,600 collected in cooperation with 195 agencies of States or their subdivisions, about 600 collected under the Federal program of the Water Resources Division and 1,700 obtained for other Federal agencies such as the Corps of Engineers, Bureau of Reclamation, Tennessee Valley Authority, State Department, Soil Conservation Service, Atomic Energy Commission, and permittees and licensees of the Federal Power Commission.

Compilation of all streamflow records in the United States for the period 1888–1950, a project which was started in 1951, is now 77 per cent complete. During the year the compilation volume for the Snake River basin was published. Formerly this type of historical and long-term streamflow data was scattered in nearly 50 volumes of the annual report series of water-supply papers.

Flood-frequency analyses for Florida, North Dakota, and South Dakota, conducted cooperatively by the Geological Survey and those States, were completed and are being prepared for publication. Regional flood-frequency analyses for the Colorado River basin, part of a nationwide flood-frequency study, were well advanced during the year.

New cooperative programs with several State highway departments were begun, and several existing programs were enlarged. Hydraulic data on about 90 bridge sites were furnished to highway departments. The program of collecting flood-flow data on small streams, by means of crest-stage gages or by establishment of gaging stations, was enlarged.

The manuscripts for two flood reports were transmitted to the printer, and the manuscripts for three others were being prepared for publication. Reports on the floods of August–October 1955, New England to North Carolina, and the floods of December 1955–January 1956 in the far Western States were in an advanced stage of preparation at the end of the year.

Rainfall-runoff analyses of maximum annual floods were made for about 825 gaging stations in the United States, including all gaging stations that record runoff from drainage areas of less than 400 square miles. The work was done with transferred funds on behalf of the Soil Conservation Service.

The first phases of a review of the nationwide stream-gaging network was completed during the year. In the review, all stream-gaging stations were classified as being either (1) hydrologic network or (2) water management. The hydrologic network provides basic data for hydrologic studies. Water management stations are operated to provide information where needed for specific purposes. The results of this review will be appraised for uniformity and adapted for use in planning the program of collecting basic surface-water data.

Interstate compacts for the apportionment of interstate waters usually include provisions for the measurement of streamflow, commonly by the Geological Survey. Sixteen such compacts are now in effect and seven others are under negotiation. Water resources investigations were made along the Canadian boundary, as required by the Boundary Waters Treaty of January 11, 1909, between the United States and Canada, or by order of the International Joint Commission.

Ground Water Investigations

The greater part of the effort in ground-water studies was applied to areal investigations and reports on the geology and ground-water

resources of geographic or hydrologic units—commonly of counties or ground-water basins—thereby contributing to the objective of ultimate nationwide coverage. The activities, however, ranged from research on the principles of occurrence and movement of water in various geologic and hydrologic environments, through the areal investigations, to systematic, continuing inventories of draft, and observations of water-level fluctuations. Research, besides adding directly to knowledge of hydrogeologic processes, provides increasingly effective techniques for the analysis of areal problems and the interpretation and reporting of the results of analyses. The continuing inventories provide records of operating experience in the ground-water reservoirs.

About 575 ground-water investigations were in progress or were completed during the year. Four-fifths of these were in financial cooperation with State and local public agencies in 44 States and the Territories of Hawaii and Guam. About one-fifth preponderantly of national interest or of direct concern to other Federal agencies, were financed wholly from Federal sources.

Results of investigations were made available to the public in 123 published reports and papers and in 146 reports released to the open file. The published reports include 22 water-supply papers, 2 hydrologic atlases, 5 circulars, 37 reports published by cooperating agencies, and 30 papers in scientific journals. About 30 additional reports were released for administrative use by Federal agencies.

Adequate supplies of ground water of good quality for most private, industrial, and municipal needs are described in many reports covering counties, quadrangles, and other subdivisions of States from Rhode Island to California. Other reports, however, show that some areas have less plentiful supplies or supplies of poor chemical quality. For example, in some coastal areas full development of apparently ample supplies of ground water is hampered wherever subsurface conditions permit sea water to move inland when the hydraulic head of the fresh water is lowered by heavy pumping.

Considerable attention is being given to the use and expansion of natural underground storage facilities, which can be made to complement surface reservoirs in water management. Artificial recharge studies near Amarillo, Tex., show that 10,000 acre-feet or more of water could be stored in the Ogallala formation beneath a square mile of land that contains the municipal McDonald well field. Studies in the San Joaquin Valley of California indicate that the gross ground-water storage capacity in the depth interval between 10 and 200 feet below the land surface in an area of 10,000 square miles is about 90 million acre-feet. In 1955 the quantity of ground water pumped for irrigation in this area was about 9 million acre-feet, or about two-

thirds of the total withdrawal of ground water for irrigation in all of California and at least a fourth of the total in the entire United States.

A report on the springs in the Snake River Valley in Idaho includes records for the period 1899–1947 and provides an invaluable basis for future measurement and investigation of the effects of water development and of the total water yield of the upper Snake River basin.

Chemical Quality of Water Investigation

Investigations of the quantity, type, source, and distribution of mineral matter in solution in natural waters were continued in 1957. During 1957 the chemical quality of about 60,000 samples of water from streams, lakes, springs, and wells was determined. Most of the samples were daily and periodic samples from about 500 sites, mostly on streams; about 7,500 analyses were of ground water. The nation-

FIGURE 15.—Survey chemist studies dissolved materials occurring in natural water.



wide program included operation of a network of sampling stations on 75 streams west of the Mississippi River to determine trends in mineral content and thus help to ensure successful continued operation of irrigation projects.

Important advances were made in the programing of quality-of-water studies on streams through the development of criteria for station network operation to satisfy minimum national needs.

In addition to the nationwide program, more intensive chemical-quality investigations were in progress in the basins of the Colorado River, Missouri River, Pecos River, and Columbia River, in the New York-New England States, and in Alaska. Chemical-quality studies of surface and ground waters were conducted in cooperation with State and municipal agencies in 16 States. Special chemical-quality studies were made also for the Department of Defense, Atomic Energy Commission, Bureau of Reclamation, Veterans Administration, Federal Housing Authority, and Public Health Service.

Reports on chemical-quality studies of particular interest, published or released during 1956, include those on an investigation of water quality in the Fort Belvoir, Va., area, 1954-55, and on the quality of surface waters for irrigation in the Western United States in 1953; a detailed reference report was prepared on the study and interpretation of the chemical characteristics of natural water; a report was prepared on a study of the salinity of water in the Delaware River estuary. Reports describing the chemical characteristics of surface waters of Virginia, Arkansas, Texas, New York, and North Carolina were prepared in cooperation with those States. Studies were begun on the uranium and radium content of ground water in several areas of the West.

Sediment Investigations

Investigations of the quantity, movement, and sources of water-borne sediments and their effects upon reservoir storage, navigable waterways, diversion works, irrigation canals, and water-supply systems were continued in 1957. Measurements were made regularly of sediment movement at about 217 sampling sites. Comprehensive sediment studies were continued in the Missouri, Middle Rio Grande, and Colorado River basins. These programs provided measurements and interpretations of sources of sediment, rates of discharge, and other pertinent facts at selected areas and locations to guide the extensive Federal programs of water development in these areas.

Assistance to the program of the Soil Conservation Service was provided by studies of sediment yields and trap efficiency of reservoirs in small watersheds in the States of North Carolina, West Virginia, Kentucky, Georgia, Nebraska, Oklahoma, and Texas. Special

sediment studies were made for the Bureau of Reclamation in the Rio Grande and Colorado River basins and in the Medicine Creek, Nebr., watershed.

Cooperative programs which integrate Federal and State data requirements in sedimentation were continued in Iowa, Wisconsin, Kentucky, Ohio, Pennsylvania, and Virginia. Included were intensive investigations of several small watersheds in Pennsylvania and Wisconsin to measure and explain changes in the runoff and sediment discharge associated with changes of land use.

Special Investigations

A comprehensive study of the hydrology and evaluation of the water resources of the Delaware River basin was started. Completion of the project is scheduled for fiscal 1959. Accomplishments to date include an open-file report on water use in the basin and an administrative report on sedimentation and ground-water resources of the basin. A report on precipitation, runoff, and evaporation is being prepared in collaboration with the Weather Bureau.

In eastern Pennsylvania, Survey geologists have continued to act as geologic consultants in a program designed to conserve anthracite coal reserves through mine drainage. During the past year they have provided the Bureau of Mines with administrative reports on geologic and hydrologic conditions affecting the feasibility of six proposed surface drainage projects and seven proposed pump installations.

Preparation of comprehensive reports on the water resources of industrial areas continued during 1957. Four reports of this series were published during the year covering Mobile, Ala., Portland, Oreg., New Orleans, La., and the San Francisco Bay area, Calif. Reports on six other localities were in preparation.

Studies of the water requirements of specific industries were continued. A report on the water requirements of the aluminum industry was printed and a report on the rayon and acetate fiber industry was in press. Studies on water requirements of the copper and petroleum industries were started. An inventory of water used in the United States during 1955 was completed and published as U. S. Geological Survey Circular 398.

Soil and Moisture Conservation

The Geological Survey continued to investigate the hydrologic and geologic conditions on public lands to provide data needed by Interior Department agencies for the wise and efficient use and management of those lands. Investigations were made of water supplies in grazing

areas in Utah, Nevada, Idaho, and California. Data on runoff and sediment yields were collected for reservoirs constructed as part of the conservation program on the public lands in Montana, Wyoming, Colorado, Utah, New Mexico, and Arizona. A project was started in the Cheyenne River basin to evaluate the effect of water spreading on water yield of the basin and on the movement of sediment.

Research and Development

Research is an essential part of the responsibilities of the Geological Survey. This research seeks new discoveries in water science, new ways of water measurements and utilization of the knowledge gained.

Some research in water science is aimed, for example, toward explaining the principles governing the movement of water and entrained sediment through river channels. This information leads to better understanding of the long-term effects of reservoir impoundments, channel modifications, and climatic variations on channel erosion and sedimentation. Water shortages in the West have highlighted the need for research on the effects on runoff after the proposed removal of upland vegetation, and of methods for suppressing evaporation from lakes and reservoirs. Advances or recessions of glaciers are being studied in relation to long-term fluctuations in water supplies. Continued increases in flood damage intensify the need for accurate methods of estimating potential floods in areas where streams have not been gaged, for the development of hydrologic principles applicable to the zoning of urban lands subject to floods. Further progress in theoretical and field studies of the mechanics of ground-water recharge have advanced understanding of the artificial recharge of depleted ground-water reservoirs.

Ultrasonic instruments for the measurement of water velocity are being tested. These instruments will make it possible for the first time to obtain continuous measurements of water speeds.

Among the new projects for interpreting basic water facts is an analysis of the relative influence of climate and vegetation on measured sediment yields. Records of storage in reservoirs are being studied to determine the amounts of water made available by present development and to devise methods for defining optimum yield from reservoir regulation.

Technical Assistance Program

Technical assistance program activities under auspices of the International Cooperation Administration were continued during fiscal year 1957 with long-term projects in progress in Afghanistan, Chile, India, Iran, Libya, Pakistan, Philippines, Peru, and Saudi Arabia at

the close of the year. Personnel were assigned for short periods to British Guiana, the Philippine Islands, and Turkey to assist in modernizing or expanding water-resources investigations.

Technical assistance continued to emphasize the establishment or strengthening of foreign governmental organizations engaged in water-resources investigations. On-the-job training in investigational methods and techniques and advisory assistance in organizational phases have been the principal means of assistance.

CONSERVATION DIVISION

The Conservation Division classifies Federal lands as to mineral and water resource values and supervises mineral-recovery under leases, permits, and licenses on Federal, Indian, and Naval petroleum reserve lands. A small headquarters staff and a field staff of competent geologists and engineers are employed. This force makes field surveys, prepares maps and reports dealing with waterpower, fuels, minerals, and chemicals essential to the mineral-resource economy of the United States, and supervises mining and drilling operations to assure the safe and economical production by private enterprise of coal, oil, gas, and other minerals.

The supervisory activities of the Division contributed or were responsible for \$132 million income to the Government for distribution to States, special funds, Indian lessors or the Federal Treasury.

Public land income is allotted 10 percent to the Federal Treasury, 37½ percent to the State from which produced (for schools and roads), and 52½ percent to the Reclamation Bureau for general use in the Western States except that in Alaska 90 percent is paid to the Territory and 10 percent to the Federal Treasury. Acquired land income is distributed according to the laws applicable thereto. Income from supervised operations on outer Continental Shelf, military, and naval lands is deposited in the United States Treasury. All income from restricted Indian land is received for the benefit of the tribe or allottee.

Mineral Classification

Geologists working from headquarters at Washington, D. C., and field offices in Alaska, Colorado, California, Montana, New Mexico, Oklahoma, Utah, and Wyoming, make specific investigations that result in geologic reports and maps primarily for use in the administration of mineral leases, and the application of efficient methods of recovery of the products involved. During the 1957 fiscal year maps and reports were completed on a part of the Williams Fork coalfield, Colorado; Twin Buttes gas field, Colorado; Ash Creek and West

Sussex (Dugout) oilfields, Wyoming; Danforth Hills and Maudlin Gulch oilfields, Colorado; Glenrock project, Wyoming; and Nesson Anticline, North Dakota. In addition a mineral map of New Mexico was prepared. Classification standards for oil shale, phosphate, potash, and oil and gas are in process of revision.

A total of 32,926 cases were processed including 5,283 cases involving the outright disposal of Federal lands, either with no reservation of minerals or with the reservation of one or more specified minerals, and 27,643 cases involving the Government's right under Federal leasing laws to lease a mineral substance from lands under its jurisdiction. This was an increase of 4,042 over the number of similar cases for the previous year. In addition initial or revised definitions of 57 producing oil and gas fields containing Federal lands were promulgated; 262 unit-plan and participating-area proposals were appraised geologically; 57 determinations were made of the productive limits of producing oil and gas deposits as found to exist on August 8, 1946; the geologic significance of 182 new discoveries of oil or gas made on or affecting Federal-land leaseholds were reported for appropriate action; the competitive sale of oil and gas leases on 15 parcels of public land was recommended; 12 appeals from decisions of the Bureau of Land Management affecting the disposal of Federal lands were reviewed and reported; and 89 miscellaneous reports were prepared on the mineral potentialities of specific lands for various agencies of the Federal Government.

Water and Power

Investigations of streams and lakes on public lands to determine their waterpower and storage possibilities are carried out from a central office in Washington, D. C., and four field offices located in Denver, Colo.; Sacramento, Calif.; Portland, Oreg.; and Tacoma, Wash. Investigatory work in Alaska is supervised from the Tacoma office. Field work during 1957 was directed mainly toward obtaining basic information on the waterpower resources and storage possibilities of Federal lands in Alaska, California, Idaho, Montana, Oregon, and Washington. Field projects completed during the year or in progress on June 30 include surveys on Baranof and Carbon Lakes on Baranof Island, Chilkoot Lake near Haines, and Tanana River, Alaska; Kaweah, Kern, Klamath, and Stanislaus Rivers, California; Lemhi River, Idaho; Clarks Fork (of Columbia River) and Rock Creek, Montana; Innaha and Deschutes Rivers, Oregon; Wind, White Salmon, and Klickitat Rivers, Washington.

The foregoing projects include 715 miles of stream-channel surveys and 16 dam site surveys. These projects normally extend over a 3-year period from start to map publication, and for the current year the

work completed would be the equivalent of about 350 miles of channel surveys and 15 dam-site surveys.

Maps resulting from previous field work were, as of June 30, in various stages of preparation for publication for 260 miles of stream topography and 9 dam sites. Maps published during the year covered 110 miles of streams and 6 dam sites. Maps completed and in process of publication cover 250 miles of streams and 9 dam sites.

During the year one report was approved for publication as a circular, one report was placed in open file, and one report was approved for publication in a technical journal. In keeping with the program of making a systematic review of waterpower withdrawals, six reports were prepared which resulted in recommendations for the outright restoration of 40,000 acres and the restoration of 35,000 acres of previously withdrawn lands, under the provisions of section 24 of the Federal Power Act. Sixty-one reports relating to water resources by other agencies were reviewed in the Washington office.

Classification activities resulted in the addition of 28,873 acres in power-site reserves and the elimination of 28,935 acres. The outstanding reserves in 23 States and Alaska show a net total of 7,128,553 acres. The total reserves for reservoir site did not change and remain at 134,823 acres. Reports were prepared and submitted to the Bureau of Land Management on 415 cases involving the waterpower value of lands affected in applications for rights-of-way and 5,283 applications for land acquisition. One hundred and ten reports on cases affecting power site lands were prepared and submitted to the Federal Power Commission.

Mining Supervision

Supervisory operations were concerned with discovery, development, and production of coal, potassium, sodium, phosphate, and oil shale from public lands; of sulfur on public lands in Louisiana and New Mexico; of silica sand on certain lands in Nevada withdrawn by Executive Order No. 5105; of gold, silver, and mercury on certain Spanish land grants; of all minerals, except oil and gas, on restricted, allotted, and tribal Indian lands; on "acquired lands" under the act of August 7, 1947, and provisions of section 402 of the President's Reorganization Plan No. III of 1946; on land in the California State Park under the act of March 3, 1933 (47 Stat. 1487); and on National Forest land in Minnesota under the act of June 30, 1950 (64 Stat. 311). Outstanding mineral leases and permits on "acquired" and Indian lands and lands subject to the above-mentioned acts involve the exploration for and production of copper, gold, iron, lead, manganese, silver, nickel, titanium, tungsten, uranium, vanadium, zinc, asbestos, bentonite, clay, coal, garnet, gravel, gypsum, feldspar, fluorspar, lime-

stone, mica, phosphate, pumice, quartzite, quartz crystal, sand, silica sand, sulfur, and vermiculite.

Mining supervision includes responsibility for investigation and reporting on applications for leases and prospecting permits; recommending lease terms enforcing compliance with lease terms and of regulations governing the conduct of prospecting, mining, and beneficiation; protecting and conserving the natural resources by preventing waste; determining royalty liability; preparing statements and receiving payment of royalties and rentals. It also involves advisory service to the Office of the Secretary, other bureaus of the Department, and other Government agencies.

As of June 30, 1957, there were under supervision 3,289 properties involved in leases, permits, and licenses in 32 States and Alaska, of which 1,920 were on public lands, 430 on acquired lands, and 939 on Indian lands. Annual production from such lands under supervision during the fiscal year is estimated at 19,162,000 tons, valued at \$143,736,000 with royalties amounting to \$7,042,000. The production of coal from public domain land in the United States and Alaska aggregated 5,531,000 tons, valued at \$31,509,000 with a royalty value of \$687,000. Production of coal in Alaska amounted to 739,000 tons. Potash production amounted to 8,049,000 tons of crude and refined salts valued at \$56,617,000 and royalty value of \$2,233,000 during the fiscal year. The principal source of sodium was Searles Lake, Calif., accounting for 641,000 tons of the total of 881,000 tons of sodium and associated compounds produced from lands under supervision. Total value and royalty value of sodium were \$22,722,000 and \$748,000 respectively. Phosphate rock and shale production was 1,409,000 tons—990,000 tons from public domain valued at \$1,904,000 with a royalty value of \$200,000; 4,000 tons from acquired lands, and 415,000 tons from Indian lands. Production of lead and zinc concentrates from Indian lands amounted to 28,000 tons valued at \$3,155,000 and royalty value of \$246,000. The output of uranium and vanadium ores from Indian lands was 1,460,000 tons valued at \$23,252,000 and royalty value of \$2,724,000. Phosphate, coal, and sand and gravel made up the major part of the remainder of the production from Indian lands totaling 1,566,000 tons valued at \$1,524,000 and royalty value of \$125,000. Coal, fluorspar, zinc, asbestos, bentonite, phosphate, mica, manganese, quartzite, quartz crystal, stone, and sand and gravel were produced from acquired lands in 13 states to an aggregate of 658,000 tons valued at \$3,047,000 and royalty value of \$79,000.

Oil and Gas Supervision

Operations for the discovery, development, and production of crude oil, natural gas, and products extracted from natural gas are super-



FIGURE 16.—Offshore oil and gas activities on the outer Continental Shelf are under supervision of the Geological Survey, Department of the Interior.

vised on Federal, Indian, and certain naval petroleum reserve lands. These duties were carried out during the year through 6 area offices and 21 district offices in California, Colorado, Louisiana, Montana, New Mexico, Oklahoma, Wyoming, and Washington, D. C.

On the public lands 106,279 oil and gas properties were under supervision at the end of the fiscal year, aggregating 77,071,099 acres in 24 States and Alaska. Drilling on public lands during the year included the spudding of 1,920 wells and the completion of 1,841 wells, of which 1,255 were productive of oil and gas. In all, 25,395 public-land wells,

including 14,663 capable of oil or gas production, were under supervision on June 30, 1957. Production was appreciably greater than in 1956, amounting to about 131,407,000 barrels of petroleum; 367,458,913,000 cubic feet of natural gas; and 216,938,000 gallons of gasoline and butane, with royalty returns to the Government of about \$50,278,000.

There were 4,490 acquired land leases embracing 3,943,000 acres in 8 States under supervision at the end of the fiscal year. Drilling on acquired lands during the year included the spudding of 83 wells and the completion of 86 wells, 32 of which produced oil and gas. In all, 608 acquired-land wells, including 261 capable of oil and gas production, were under supervision on June 30. Including compensatory royalty allocated to the Rio Vista gas field the production from acquired land was about 6,182,000 barrels of petroleum; 15,598,489,000 cubic feet of natural gas; and 385,500 gallons of gasoline and butane, with royalty returns of about \$2,822,000.

Operations were supervised on 11,265 leaseholds, embracing 3,574,796 acres on Indian lands in 19 States. Drilling on Indian lands during the year included the spudding of 722 wells and the completion of 723 wells, of which 487 produced oil and gas. In all, 9,308 Indian land wells, including 5,363 capable of oil and gas production, were under supervision on June 30. Revenues from rentals, royalties, and bonuses on Indian land amounted to about \$55,086,000.

Drilling on military lands during the year included the spudding of 9 wells and the completion of 7 wells, 6 of which were productive of oil and gas. In all, 64 military land wells, including 57 capable of oil and gas production, were under supervision on June 30. Royalty on the production of oil, gas and liquid petroleum gases from military lands amounted to \$2,387,000.

On behalf of the Department of the Navy, supervision was continued over operations for the production of oil, gas, gasoline, butane, and propane from 17 properties under lease in Naval Petroleum Reserve No. 2 in California. Production from 291 active wells totaled 2,413,000 barrels of petroleum; 6,138,763,000 cubic feet of natural gas, of which 2,870,005,000 were net sales, the remainder being gas injected for pressure maintenance, shrinkage from the extraction of liquid products, or fuel used on leases; and 10,195,000 gallons of natural gasoline with an aggregate royalty value of \$1,129,000.

Work on the outer Continental Shelf involved supervision of 298 leases, originally issued by the States of Louisiana and Texas, and over which jurisdiction was assumed by the Federal Government under section 6 of the outer Continental Shelf Lands Act, and 235 leases issued under section 8 of that act, containing at the end of the year a total of 896 wells, 481 of which were productive of oil and gas. Drilling on the outer shelf involved the spudding of 322 wells,

and the completion of 286, including 177 producers. The production of petroleum from the outer shelf in 1957 was about 58 percent greater than during 1956 and the production of gas was about 4 percent less than during 1956. Revenues received during the year, as royalties and rentals, totaled \$13,306,000.

Activities toward unitization of oil and gas operations involving Federal land were reflected in the approval of 55 new unit plans during the year and the termination of 42 previously approved unit plans, leaving 298 approved plans covering 5,030,642 acres outstanding. On the outer Continental Shelf 3 such plans were approved during the year and the total now stands at 12, embracing 329,156 acres. About 50 percent of the petroleum, 29 percent of the natural gas and 57 percent of the gasoline and butane obtained from Federal lands during the year was produced under approved unit agreements. On Indian lands 5 new units were approved and 3 were terminated, the total number of plans in effect at the end of the year being 30, involving 43,970 acres. There were 117 drilling-unit, or communitization agreements approved during the year, making a total of 680 as of June 30. There was one development contract covering 71,166 acres in New Mexico approved during the year and 182,703 acres were eliminated from the Katalla-Yakataga development contract in Alaska. The total number of such approved contracts outstanding on June 30 was 8, involving 3,254,129 acres.

TOPOGRAPHIC DIVISION

The Topographic Division prepares and maintains the National Topographic Map Series covering the United States and its Territories and possessions. This involves operations and research in five major work phases: aerial photography, geodetic control, photogrammetric and field compilation, cartography and editing, and printing. Related activities include the preparation of special maps and the supplying of advance map materials, aerial photography, geodetic control lists, and map information.

During the year, about 1,490 new topographic maps were published. Mapping projects were under way in every State, the District of Columbia, Alaska, the Hawaiian Islands, Puerto Rico, and the Virgin Islands. About 20,000 topographic maps are now published and distributed by the Geological Survey.

The recommendations of the President's Cabinet Committee on Minerals Policy have had the effect of accelerating the mapping of many quadrangles and the selection of others for new starts to provide topographic bases for geologic mapping. Similarly, additional mapping has been started to implement the recommendations of the

President's Advisory Committee on Water Resources Policy. New and enlarged cooperative programs have resulted in substantial increases in the number of projects which help to meet civil mapping needs. Another important influence affecting the planning of mapping programs was that of civil defense. The military defense mapping program, begun in 1951, continued to absorb a large amount of mapping capacity and was expanded somewhat as additional priority requests were received.

The Topographic Division, through the International Cooperation Administration, extended technical assistance to accredited representatives of other nations. Periods of technical training were provided to 4 foreign nationals and tours of our mapping facilities were arranged for about 35 others. Representatives of the Division participated in the meetings of the International Society of Photogrammetry and the Esselte Conference on Applied Cartography, both held in Stockholm, Sweden, during July and August 1956.

A new cartographic office for map finishing was opened at Menlo Park, Calif., as part of the existing Geological Survey center.

Mapping Programs and Map Production

Within the continental United States, nearly 1,300 permanently marked triangulation stations were established to provide control for areas totaling more than 50,000 square miles. About 4,500 linear miles of transit traverse and about 15,000 linear miles of leveling were run, with permanent marks established at intervals of 2 to 3 miles. The computed results of these surveys are made available, on request, to other Government agencies and to the public.

In Alaska all field control was completed for the entire 125,000 square miles of the remote Brooks Range area, involving 30,000 square miles of triangulation and trigonometric leveling. Twenty-five parties utilizing six helicopters and additional conventional aircraft were engaged on this project.

Contracts were let for 146,200 square miles of precision aerial photography for topographic mapping purposes. The Air Force delivered aerial photographs covering 11,000 square miles for use in compiling topographic maps required by the Department of Defense. The project of photographing the Brooks Range area in Alaska started in 1955, was completed.

During the year 2,516 maps were sent to the Publications Office for printing and distribution. New 1:500,000-scale State maps of Oregon and Arizona were printed and new maps of Colorado and Virginia were completed and sent forward for reproduction. Compilation is in progress or planned for the new State maps of Kentucky, Maine, Montana, North Carolina, Tennessee, Texas, and Washington. Of

the 2,516 completed map manuscripts, 1,184 were new standard topographic quadrangles prepared by the Geological Survey and 64 were new maps compiled by other agencies but published and distributed by the Geological Survey by interagency agreement. Also included were 199 Geological Survey revisions, 708 reprints of existing maps, 59 one-color advance editions, and 77 State index maps. In addition, there were 135 civil editions of maps which had been published by the Department of Defense for military use, and 15 miscellaneous maps.

Considerable mapping was done in relation to civil defense requirements, including a continuation of the accelerated program to prepare urban area maps of critical targets. Standard urban area maps for 19 cities were prepared for reproduction and maps for 16 additional cities are in progress. In addition, 52 one-color map assemblies were printed for the Federal Civil Defense Administration at scales of 1:24,000 and 1:62,500, covering the urban and surrounding support areas of seven major cities.

Increased use of helicopters for transportation of personnel and equipment to remote or high areas difficult of access, was made during the year. New higher-powered helicopters permitted safe landings on 17 peaks over 12,000 feet, including Mount Whitney and Mount Rainier.

After new mapping has been completed, it is necessary to plan a program of map revision. Programs for revising map coverage of the entire areas of Massachusetts, Rhode Island, Connecticut, Kentucky, and Puerto Rico, and of areas in other States and Territories are underway. Revised maps in Massachusetts, Connecticut, and Rhode Island will be published at 1:24,000 scale rather than at the present scale of 1:31,680. All other 7½-minute quadrangle maps in these three States are also to be converted to 1:24,000 scale during the fiscal years 1957-59.

An important contribution to defense was continued during the year in the preparation of special-use charts for the Aeronautical Chart and Information Center of the United States Air Force. The 237 charts of foreign areas prepared for this agency included 123,000 square miles of new compilation and 40,000 square miles of map revision.

One hundred eighty-five special-use maps were completed for the various Divisions of the Geological Survey, the Department of Justice, the Forest Service, the National Park Service, the Federal Civil Defense Administration, and the Army Map Service.

During fiscal year 1957, cooperative programs were in effect in 30 States, Puerto Rico and the Virgin Islands. The States of Georgia, Kansas, Pennsylvania, West Virginia, the Commonwealth of Puerto Rico, and Oklahoma City, Okla., increased their contributions to ex-

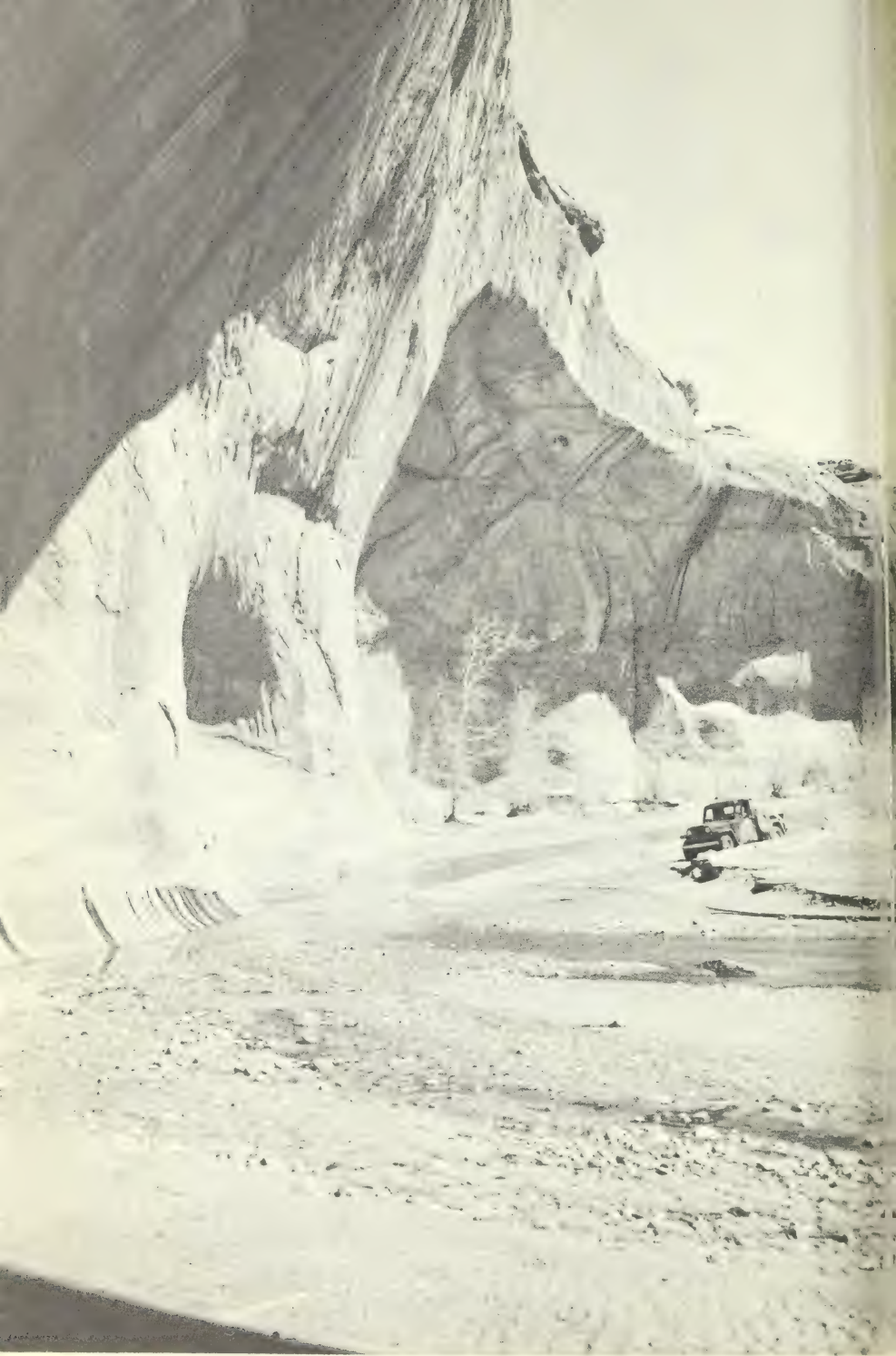


FIGURE 17.—Interior Department topographic engineers often traverse such extremely difficult terrain as this view, showing a Geological Survey truck in the Orange Cliffs area, Utah, indicates.

isting programs and the Lower Colorado River Authority in Texas, State of Ohio, Summit County, Ohio, and the Virgin Islands, started new programs. Total cooperative offerings during the year amounted to about \$1,550,000.

A detailed summary of map production is shown in the following table:

Area (in square miles) mapped during fiscal year 1957 for publication on standard scales

[Contour interval, 5 to 100 feet]

| State | Area mapped, scale | | New map- ping | Revised mapping | Total |
|---------------------------|--------------------|----------------------|-----------------------|----------------------|-----------------------|
| | 1:24, 000 | 1:62, 500 | | | |
| Alabama..... | 245 | 1, 246 | 1, 491 | | 1, 491 |
| Arizona..... | 1, 059 | 3, 903 | 3, 169 | ¹ 1, 968 | ¹ 5, 137 |
| Arkansas..... | | | | | |
| California..... | 1, 911 | 10, 127 | 10, 554 | 1, 484 | 12, 038 |
| Colorado..... | 2, 879 | 961 | 2, 893 | 947 | 3, 840 |
| Connecticut..... | 642 | | | 642 | 642 |
| Delaware..... | | | | | |
| District of Columbia..... | 54 | | 54 | | 54 |
| Florida..... | 807 | | 807 | | 807 |
| Georgia..... | 733 | 1, 821 | 2, 554 | | 2, 554 |
| Idaho..... | 464 | 4, 610 | 5, 074 | | 5, 074 |
| Illinois..... | 258 | 2, 177 | 1, 483 | 952 | 2, 435 |
| Indiana..... | 3, 102 | | 2, 299 | 803 | 3, 102 |
| Iowa..... | 1, 214 | 337 | 1, 551 | | 1, 551 |
| Kansas..... | 2, 703 | | 2, 514 | 189 | 2, 703 |
| Kentucky..... | 511 | | 1 | 510 | 511 |
| Louisiana..... | 437 | 6, 100 | 2, 519 | 4, 018 | 6, 537 |
| Maine..... | 427 | 2, 437 | 283 | 2, 581 | 2, 864 |
| Maryland..... | 884 | | 243 | 641 | 884 |
| Massachusetts..... | 428 | | | 428 | 428 |
| Michigan..... | 193 | 3, 087 | 3, 076 | 204 | 3, 280 |
| Minnesota..... | 715 | 2, 119 | 2, 834 | | 2, 834 |
| Mississippi..... | | 758 | 758 | | 758 |
| Missouri..... | 801 | | 638 | 163 | 801 |
| Montana..... | 1, 469 | 2, 249 | 3, 718 | | 3, 718 |
| Nebraska..... | 1, 751 | | 1, 751 | | 1, 751 |
| Nevada..... | 92 | 7, 492 | 7, 584 | | 7, 584 |
| New Hampshire..... | 206 | 1, 515 | 63 | 1, 658 | 1, 721 |
| New Jersey..... | 131 | | 126 | 5 | 131 |
| New Mexico..... | 283 | 2, 227 | 2, 510 | | 2, 510 |
| New York..... | 1, 964 | 661 | 1, 752 | 873 | 2, 625 |
| North Carolina..... | 648 | 1, 493 | 2, 091 | 50 | 2, 141 |
| North Dakota..... | 786 | | 786 | | 786 |
| Ohio..... | 123 | | 123 | | 123 |
| Oklahoma..... | 1, 000 | 1, 489 | 2, 489 | | 2, 489 |
| Oregon..... | 634 | 6, 938 | 4, 116 | 3, 456 | 7, 572 |
| Pennsylvania..... | 804 | 1, 020 | 335 | 1, 489 | 1, 824 |
| Rhode Island..... | 107 | | | 107 | 107 |
| South Carolina..... | 277 | 1, 526 | 1, 287 | 516 | 1, 803 |
| South Dakota..... | 2, 464 | 10 | 2, 474 | | 2, 474 |
| Tennessee..... | 1, 022 | | 1, 022 | | 1, 022 |
| Texas..... | 3, 458 | 4, 798 | 7, 324 | 932 | 8, 256 |
| Utah..... | 4 | | 4 | | 4 |
| Vermont..... | | 534 | 85 | 449 | 534 |
| Virginia..... | 877 | 629 | 508 | 998 | 1, 506 |
| Washington..... | 1, 026 | 2, 873 | 3, 600 | 299 | 3, 899 |
| West Virginia..... | 798 | | 798 | | 798 |
| Wisconsin..... | 225 | 942 | 1, 005 | 162 | 1, 167 |
| Wyoming..... | 807 | 3, 100 | 3, 907 | | 3, 907 |
| Total..... | 41, 423 | 79, 179 | 94, 253 | ¹ 26, 524 | ¹ 120, 777 |
| Alaska..... | | ² 26, 676 | ³ 38, 278 | | 38, 278 |
| Hawaii..... | 1, 331 | | 1, 331 | | 1, 331 |
| Puerto Rico..... | ⁴ 364 | | | 364 | 364 |
| Virgin Islands..... | | | | | |
| Total..... | 43, 118 | 105, 855 | ³ 133, 862 | ¹ 26, 888 | ¹ 160, 750 |

¹ Includes 175 square miles 1:48,000.

² 1:63,360.

³ Includes 11,602 square miles 1:250,000.

⁴ 1:20,000.

Research and Development

Research and development activities to provide more efficient and economical methods of map production were continued and somewhat accelerated in the past year.

New instruments and equipment for control surveys were developed, tested, and adopted. Levels that automatically maintain a horizontal line of sight are now standard equipment for basic leveling.

The Division has purchased a new microwave radio device for accurately measuring distances ranging from a few hundred feet to about 30 miles. This instrument is expected to reduce the cost of horizontal control surveys materially and at the same time achieve a significant increase in accuracy.

Intensive laboratory research in altimetry continued with the construction of a barostat to provide an absolute standard for calibrating altimeters. A large amount of data on the behavior of altimeters is being accumulated as a basis for developing improved field techniques and office computations.

With the acquisition by the Survey of an electronic computer, appropriate problems are being programed for automatic computation. The first major problem will be the conversion of all geographic positions to X and Y coordinates on the State plane coordinate systems. Also in the field of computation and adjustment, four new, improved and enlarged Electrical Survey-Net Adjusters (ESNA's) have been constructed for use in the four regional offices of the Topographic Division.

Progress continued in the development of new photogrammetric instruments and techniques. A transforming printer for making equivalent vertical prints from 20° low-oblique photographs was developed by a commercial firm in accordance with Geological Survey specifications. An automatic electronic dodging device was procured and installed on a projection-type diapositive printer. Preliminary tests indicate a significant improvement in the quality of prints, and plans are being made to equip all diapositive printers with automatic dodgers.

A system for precisely controlling the geometric characteristics of diapositives is also being developed as an aid in achieving the greater accuracies now being sought in photogrammetric operations. The system will include control of film temperature and humidity, precise measurement of film dimensions to insure correct adjustment of the printer, and rigid control of the flatness of diapositive plates.

A complete redesign of the prototype Orthophotoscope has been undertaken. This instrument, developed by the Geological Survey,

produces equivalent orthographic prints from stereoscopic pairs of conventional perspective aerial photographs.

A complete photogrammetric system for compiling contoured "maps" of sand configurations in a hydraulic test flume was developed and tested for the Water Resources Division. The system may be expected to replace slower hand methods of measuring the effect of water flow in hydraulic flumes.

The scribing technique is now firmly established in stereocompilation, field surveying, and color separation, permitting closer integration of those phases of map production.

A map evaluation program was put into operation during the year. The main objective of this program is to provide data with which to determine the most efficient and economical methods of map production. A related objective is to insure that the maps tested and checked under this program comply with the national map accuracy standards.

Contour-interval plans for 38 States have been prepared. These plans show the proposed contour intervals for both 15-minute and 7½-minute topographic maps.

In cooperation with the Interdivision Committee on Photogrammetric Techniques in Geology, training courses in photogrammetry were provided for geologists and engineers in other Divisions of the Survey. These courses covered the fundamentals of photogrammetry and its application to various activities of the several Divisions.

Map Information

Facilities for supplying information on maps, aerial photography, and geodetic control surveys to Federal, State, and local government agencies, and the public, are maintained at the Map Information Office in Washington and at the Division's field offices. Services include over-the-counter map sales for the convenience of the public, commercial firms, and government agencies, and assembly of special map, photographic and geodetic control data to meet the requirements of the Geological Survey and other Federal agencies.

During the year, geodetic-position data for civil defense purposes were compiled for key installations of the Geological Survey and for a large number of mining facilities throughout the United States as requested by the Bureau of Mines.

The Map Information Office serves as the central depository for the maps which make up the National Atlas of the United States, and maintains a periodically revised list of all maps issued for the atlas. Seventeen maps of the atlas, showing climatic conditions, population, farming, and topographic mapping have been published at 1:10,000,000 scale, by four Federal agencies.

The seventh edition of the index Status of Topographic Mapping was published in two sheets. The eighth edition of the index Status of Aerial Photography in the United States was published in one sheet with inset maps showing Alaska, Hawaii, and Puerto Rico. This edition shows aerial photography for more than 99 percent of the area of the continental United States, 75 percent of the Hawaiian Islands, and 100 percent of Alaska and Puerto Rico.

A list of aerial photographs for areas covered by a set of one hundred topographic maps that illustrate specified physiographic features was prepared for those interested in photography for educational use. The list identifies the photographs, gives the dates and scales of each, and names the agency from which reproductions may be ordered.

Training films on topographic-mapping procedures were widely circulated during the year. They were used by the military services in training personnel assigned to surveying and mapping units and foreign trainees under the military assistance program of the Department of Defense; also by other Federal agencies for foreign trainees under the technical assistance program of the Department of State.

The films were shown at surveying and mapping conferences, to engineering groups throughout the country, and were used extensively in educational institutions for instruction in engineering, forestry, and geology. These films were viewed by at least 12,000 persons at more than 400 showings.

PUBLICATIONS

The primary purpose of the Geological Survey is to provide for the people and the agencies of Government, information necessary for the exploration, development, and conservation of our mineral and water resources. As this information becomes available through investigations, surveys, and research, fulfillment of this purpose is served by publication of a variety of reports, maps, and charts. The information is published in part by the Survey, in part by cooperating States, and in part by many scientific journals. These publications include maps of the topographic and geologic features of the Nation, studies of mining districts and mineral deposits, of the composition and structure of rocks and minerals, of fossils and the rocks in which they are found, of geophysics and geochemistry, and studies of streamflow, ground waters, and their chemical quality.

During fiscal 1957, 767 reports including geologic and hydrologic maps were submitted for publication. Of these 308 were for publication by the Geological Survey, 31 as professional papers, 71 as bulletins, 64 as water-supply papers, 9 as circulars, and 133 in the various

map series, and the remainder for publication by cooperating agencies or scientific journals.

Preparation

In this period 213 new manuscripts were sent to the printer and 181 were published. Work on new manuscripts prepared in fiscal year 1957 included the editing of 28,259 pages; checking of 5,926 galley proofs and 11,520 page proofs. Printed reports delivered included 17 professional papers, 68 bulletins, 56 water-supply papers, 27 circulars, 4 chapters for the new edition of the topographic manual, and 9 miscellaneous.

Illustrations to accompany reports published by the Survey were prepared at an increased rate. Completed and transmitted for publication were illustrations for 114 reports. The 47 bulletins, 30 professional papers, 32 water-supply papers, 4 circulars, and 1 hydrologic atlas required 1,946 drawings and photographs, of which 134 were for multicolor reproduction.

Final copy for 133 geologic maps for publication in the Geological Survey's map series and 2,516 topographic and related maps were transmitted for reproduction.

Map Reproduction

The following is a summary of map reproduction work completed during the year:

| | New | Reprinted |
|---------------------------------------|--------------------|------------------|
| Topographic Division maps: | | |
| Standard topographic..... | ¹ 1,458 | ⁴ 376 |
| Standard topographic (engraving)..... | 7 | 151 |
| Standard topographic (revisions)..... | ² 183 | |
| 1:250,000 scale..... | ³ 19 | ³ 32 |
| Scale conversion..... | | 44 |
| Planimetric..... | 3 | 20 |
| State base..... | 6 | 11 |
| State topographic indexes..... | 80 | |
| Miscellaneous..... | 1 | 17 |
| Geologic Division: | | |
| Geologic quadrangle..... | 15 | |
| Mineral investigation..... | 67 | |
| Geologic indexes..... | 4 | 4 |
| Oil and gas maps..... | 11 | 6 |
| Oil and gas charts..... | 1 | 7 |
| Geophysical investigations..... | 22 | 1 |
| Geologic status..... | 1 | |
| Miscellaneous investigations..... | 75 | |
| Conservation Division: | | |
| River survey..... | 10 | |
| Total..... | 1,963 | 669 |

¹ Includes 1 printed by other Government agency.

² Includes 4 printed by other Government agencies.

³ 30 printed by other Government agencies.

⁴ Includes 32 printed by other Government agencies.

These 2,632 new and reprinted map editions comprise 7,683,034 copies of which 7,524,309 copies were printed in the Survey's plant. These maps range in size from 18 by 22 inches to 50 by 72 inches.

In addition to the foregoing production, 1,259 jobs comprising miscellaneous maps and other preliminary map services were completed. This printing includes 277 maps amounting to 604,320 copies of which 128 were illustrations comprising 437,925 copies for the Government Printing Office. Also, 2,300 type jobs (impressions on cellophane for map preparation) were delivered, and 827 maps were mounted on cloth.

A summary of the work performed in the Survey's plant includes: Reproduction and delivery of 8,128,629 map copies (40,027,177 impressions); preparation of 12,832 photolithographic printing plates, 933 printing plates, 9,361 photolithographic negatives, 23,317 photographic negatives and positives ranging from 2 by 2½ inches to 30 by 40 inches, 11,849 prints ranging from 2 by 1½ inches to 40 by 72 inches; developing and printing 88 rolls of film; preparation of 518 lantern slides; and the mounting of 151 prints.

Distribution

The warehousing of Geological Survey publications is handled through facilities at Washington, Denver, and Fairbanks. Distribution of maps, folios, and circulars from these points is aided by 12 other Survey field offices. Further distribution is carried out by 473 commercial agents who purchase maps for resale to the public.

In addition to approximately 35 million items on hand at the beginning of the year, 234,000 copies of 263 separate reports in book and pamphlet form (printed by the Government Printing Office and the Interior Duplicating Section) and 7,683,034 copies of 2,632 new and reprinted maps (printed by the Geological Survey) were received.

The distribution of approximately 3,785,000 maps and indexes, and 265,000 book reports and pamphlets during fiscal year 1957 was an increase of 475,000 copies over the preceding year and represented the largest annual volume of distribution by the Geological Survey to date. In addition, more than 115,000 copies of the Survey's monthly announcements of new publications were distributed. This total distribution was accomplished through the receipt of more than 200,000 individual requests and resulted in the receipt of \$411,600 from the sale of maps to the public, which amount was deposited as miscellaneous receipts in the United States Treasury.

The total number of copies distributed by the Geological Survey offices as compared with fiscal year 1956 is shown in the following table:

| | Fiscal year 1956 maps, reports and indexes | Fiscal year 1957 maps, reports and indexes | Percent increase or decrease |
|---------------------------|---|---|------------------------------------|
| Washington | 2, 438, 250 | 2, 565, 500 | +5 |
| Denver | 878, 550 | 1, 191, 300 | +36 |
| Fairbanks | 44, 200 | 36, 900 | -17 |
| Other field offices | 198, 950 | 257, 950 | +30 |
| Total | 3, 559, 950 | 4, 051, 650 | +14 |

Public Inquiries Offices

Public Inquiries Offices have been established in the following cities: Dallas, Tex.; Denver, Colo.; Salt Lake City, Utah; San Francisco and Los Angeles, Calif.; and Anchorage, Alaska. These offices carry stocks of Survey maps and reports concerning their respective areas, answer all types of inquiries, and direct specific questions on technical matters to appropriate Division technical officers. Maps and reports are sold "over-the-counter," but the offices are not equipped to handle mail orders. Operation of these offices facilitates distribution of the results of Survey investigations to the public.

FUNDS

During the fiscal year 1957, obligations were incurred under the direction of the Geological Survey totaling \$53,076,509. Of this amount 59 percent was appropriated directly to the Geological Survey, 27 percent was made available by other Federal agencies, and 14 percent by States or their political subdivisions, and miscellaneous non-Federal entities.

Source and use of funds in fiscal year 1957

Topographic surveys and mapping:

Geological Survey appropriation..... \$12, 872, 859

Reimbursements from non-Federal sources:

States, counties, and municipalities..... \$1, 545, 078

Sales to the public of aerial photographs and
photographic copies of records..... 133, 614

Miscellaneous..... 49, 638

1, 728, 330

Reimbursements from other Federal agencies:

Bureau of Reclamation..... \$1, 071, 425

Department of the Air Force..... 658, 496

Department of the Army..... 539, 623

Miscellaneous..... 187, 905

2, 457, 450

Total appropriation and reimbursements..... 17, 058, 639

Direct State payments..... 9, 215

Total, topographic surveys and mapping..... 17, 067, 854

Geologic and mineral resource surveys and mapping :

| | | |
|---|-------------|---------------|
| Geological Survey appropriation----- | | \$6, 776, 314 |
| Reimbursements from non-Federal sources : | | |
| States, counties, and municipalities----- | \$311, 445 | |
| Miscellaneous----- | 18, 098 | |
| | | 329, 543 |
| Reimbursements from other Federal agencies : | | |
| Defense Minerals Exploration Administra- tion----- | \$468, 558 | |
| Department of the Army----- | 1, 095, 647 | |
| Department of the Navy----- | 334, 220 | |
| Atomic Energy Commission----- | 4, 895, 760 | |
| International Cooperation Administration---- | 774, 267 | |
| Government Printing Office—map reproduc- tion----- | 108, 400 | |
| Miscellaneous----- | 228, 978 | 7, 905, 830 |
| Total, 'geologic and mineral resource surveys and mapping----- | | 15, 011, 687 |

Water resources investigations :

| | | |
|--|---------------|--------------|
| Geological Survey appropriation----- | | 8, 511, 012 |
| Reimbursements from non-Federal sources : | | |
| States, counties, and municipalities----- | \$4, 169, 631 | |
| Permittees and licensees of the Federal Power Commission----- | 153, 927 | |
| Miscellaneous ----- | 41, 073 | |
| | | 4, 364, 631 |
| Reimbursements from other Federal agencies : | | |
| Bureau of Reclamation----- | \$1, 112, 406 | |
| Department of the Army----- | 1, 350, 410 | |
| Department of Agriculture----- | 337, 673 | |
| Atomic Energy Commission----- | 348, 529 | |
| International Cooperation Administration---- | 435, 377 | |
| Department of State----- | 104, 787 | |
| Tennessee Valley Authority----- | 87, 952 | |
| Miscellaneous ----- | 314, 403 | 4, 091, 537 |
| Total appropriation and reimbursements----- | | 16, 967, 180 |
| Direct State payments----- | | 963, 470 |
| Total water resources investigations----- | | 17, 930, 650 |

| | |
|---|----------|
| Soil and moisture conservation : Geological Survey appropriation----- | 129, 466 |
|---|----------|

Conservation of lands and minerals :

| | |
|--|-------------|
| Geological Survey appropriation----- | 1, 940, 459 |
| Reimbursements from non-Federal agencies : Miscellaneous-- | 1, 449 |
| Reimbursements from other Federal agencies : Miscellaneous-- | 44, 944 |
| Total, conservation of lands and minerals----- | 1, 986, 852 |

| | |
|--|-------------------------|
| General administration: Geological Survey appropriation----- | ¹ \$950, 000 |
| <hr/> | |
| Summary: | |
| Geological Survey appropriation----- | 31, 180, 110 |
| Reimbursements from non-Federal sources: | |
| States, counties and municipalities----- | \$6, 026, 154 |
| Miscellaneous ----- | 397, 799 |
| | <hr/> |
| | 6, 423, 953 |
| Reimbursements from other Federal agencies----- | 14, 499, 761 |
| | <hr/> |
| Total appropriation and reimbursements----- | 52, 103, 824 |
| Direct State payments----- | 972, 685 |
| | <hr/> |
| Grand total----- | 53, 076, 509 |

¹ Excludes \$534,489 reimbursements from other agencies, which are included under the substantive activities.

BUREAU OF MINES

Marling J. Ankeny, *Director*



FOREWORD

AT THE END of the fiscal year, the Bureau of Mines could look back upon its 47th year of service to the Nation as a period of continuing achievement in promoting conservation and development of mineral resources and safety and health in the mineral industries.

During the year the Bureau launched many new research projects and saw industry adopt new equipment and techniques it had developed. The Bureau substantially increased its helium-production capacity and met new challenges in its effort to reduce hazards in the country's mines and mineral-processing plants.

The Bureau planned new undertakings to carry on its mission of helping assure adequate and continuing supplies of minerals necessary for the Nation's economic health and military security.

New projects begun during the year included compilation of detailed information on domestic reserves of copper, lead, and zinc; obtaining basic facts on refractory oxides for ultra-high-temperature use, such as jet-engine components; producing high-purity boron experimentally and determining its properties; developing methods for improving the mineral industries' water-supply situation; and determining the hydration characteristics of gypsum plaster.

Bureau-developed equipment and techniques adopted by industry during the past 12 months included a top-fired scrap preheater that cuts steelmaking costs, a solvent-extraction process for treating uranium ores of the Colorado Plateau, and a feldspar-jigging method adapted for use in coal-preparation plants.

In addition, industry began pilot-plant tests of a Bureau-developed process for separating magnesium and cadmium in magnesium-cadmium-aluminum alloy scrap.

Destined to use Bureau-created processes, two commercial plants were being constructed during the year. One, in Arkansas, was de-

signed to upgrade domestic bauxite for producing alum, and the other, in Oklahoma, to separate columbium and tantalum.

Continuing programs in which definite progress was attained composed most of the Bureau's work during the year. Technical and economic studies covered many commodities among the minerals, metals, and fuels. They included work on problems of immediate national need as well as on long-range assignments.

To meet current requisites, the Bureau collected and analyzed information on mineral and fuel production, requirements, and reserves in the United States and abroad and was a technical consultant to agencies concerned with national defense. It conducted additional research on special problems for such agencies.

Anticipating demands in the more distant future, the Bureau counted gains in its studies to increase the recovery of ores, coal, and petroleum, ranging from research on the basic principles of ground support and breaking rock with explosives to investigations of novel mining techniques that have been found effective under conditions commonly encountered.

During the year the Bureau completed the design and construction of an improved model of the phosphate-rock planer it had developed previously. At year's end, this device was installed for testing in an operating mine in Montana. It is a type of continuous mining machine adapted for steeply pitching, bedded deposits of hard material, and its usefulness in mining other ores than phosphate rock is envisioned.

Development of a similar machine for mining anthracite also advanced, as did studies seeking improved efficiency in all phases of mining bituminous coal and lignite mechanically. Typical was a study of various underground coal-haulage systems to give operators a sound basis for selecting equipment suitable for their mining conditions.

Metallurgical research was active in many fields. The Bureau studied the common metals, both ferrous and nonferrous, to improve recovery and lower production costs, thus making it possible to utilize lower-grade ores.

The Bureau also counted progress in the technology of the newer and less common metals. It developed a method of producing super-high-purity titanium by electrorefining scrap and offgrade sponge and demonstrated that intricate titanium shapes can be produced by casting. In the complex problem of separating the rare-earth metals, it advanced notably in the first stage—developing accurate analytical techniques. Moreover, it continued the quest for better and less costly methods for producing two Bureau-developed metals—zirconium and hafnium.

Studies of coal preparation and utilization were influenced by anticipated growing requirements and by continued depletion of high-

grade coking-coal reserves. Methods were sought to clean fine sizes more economically, and the suitability of various coals for use in blends to produce metallurgical coke was determined. Research was continued to learn the effect of preheating coal on the quality of coke. The Bureau also continued research on low-temperature carbonization, a process that appears promising for producing chemicals from coal.

More efficient methods were sought for producing synthesis gas and high-heat-value gas from coal of all ranks, from lignite to anthracite. Other studies dealt with the feasibility of using anthracite (alone or in blends with coke) for metallurgical fuel and with methods of pretreating the anthracite.

The Bureau maintained a well-balanced economic and technologic research program on petroleum and natural gas. During the Suez crisis it provided facts used by Government agencies in authorizing rearranged petroleum production and distribution patterns.

During fiscal 1957, Bureau petroleum-production engineers discussed the Bureau's research program with leaders at industry research centers; these discussions will be reflected in even greater emphasis on basic research and survey-type reporting. Reports on improved production methods, based on Bureau research and on engineering studies of selected oil fields, are being utilized by industry to increase the recovery of petroleum.

As part of its extensive studies in petroleum chemistry, refining, and thermodynamics, the Bureau completed analyses of 274 domestic and foreign crude oils, including 14 from the Middle East. Such information enables refiners to select crude oils best suited for specific end products.

To help assure adequate future supplies of gasoline and other liquid fuels, the Bureau also continued laboratory research on the production of synthetic fuels from coal and oil shale. Regarding coal, this work dealt primarily with improving the two processes—direct hydrogenation and gas synthesis. In oil shale, research centered on laboratory studies involving the nature of kerogen and the constitution and characteristics of shale oil produced by different retorting methods.

The Bureau, world's only large-scale producer of helium, processed more than in any previous year. By year's end, some of the new units at the expanded Exell, Tex., plant were in operation. The increased output from this installation promised to help the Bureau meet essential needs for the next few years. However, increasing consumption, limited known reserves of helium-bearing natural gas, and sale of a growing volume of such natural gas for use as fuel without prior removal of the helium caused concern lest it may be impossible to meet helium demands after 1975–80 unless prompt

conservation measures are adopted. The Bureau is cooperating with other Government agencies in attacking the problem of developing adequate ways to prevent the loss of remaining helium resources, most of which are privately owned.

Improved safety and health conditions in the mineral industries remained a prime responsibility of the Bureau. Changing methods, practices, and equipment led to some modification of programs, and special attention was given to problems of mine-roof support, exposure to airborne dusts, coal-mine fire and explosion hazards, and radioactive exposure.

Cooperating with other agencies, the Bureau backed a nationwide campaign to prevent coal-mine roof-fall injuries; by year's end, several hundred mines were enrolled in the program.

Roof bolting, introduced in 1947 to the coal-mining industry by the Bureau of Mines, continued to increase in use and effectiveness. In the calendar year 1956, only 4 fatalities were attributed to failure of bolted roof, compared with 6 in 1955.

The Bureau prepared to extend its approval program to include devices to protect workers against inhalation of radioactive particles. A committee to advise the Bureau on respiratory protection against radioactive materials was formed; it includes representatives of the Atomic Energy Commission, the Atomic Energy Commission contractors, the Industrial Hygiene Foundation, the Industrial Medical Association, the Industrial Safety Equipment Association, and the United States Public Health Service.

As a result of a change during the year in collecting injury statistics, the Bureau will be able for the first time to compute severity as well as frequency rates for the Nation's ore mines. Heretofore this was possible for the coal-mining industry only.

The year's coal-mine safety record was marred by two major explosion disasters, the first of which ended a 26-month disaster-free period. Nevertheless, the Bureau felt that the Nation's coal mines offered safer working conditions generally than in the past. Factors in this decline included 16 years of Federal coal-mine inspection; growing cooperation in safety efforts among State mining departments, mine operators, the mine workers' union, and the Federal Bureau of Mines; and steady extension of accident-prevention training throughout the industry.

Training has been a major phase of the Bureau's safety program since the initial first-aid classes were organized in 1911; it received greater attention than ever during the year. Some 17,000 men took the Bureau's 20-hour coal-mine accident-prevention course, bringing the number completing it since 1947 to approximately 195,000. Experience has shown that this course is most effective when every workman and official at a mine has completed it; accordingly, the Bureau



FIGURE 18.—Pilot-scale equipment installed by the Bureau of Mines in Pennsylvania for calcining anthracite preparatory to tests seeking its wider use as a metallurgical fuel.

strengthened its efforts to obtain 100-percent participation, in many instances supported enthusiastically by management and labor. The course deals with safety aspects of all phases of coal-mine operation; in presenting it at a given mine, Bureau instructors emphasize material directly applicable to methods and equipment actually used.

Although concentrating heavily on coal mines, the Bureau did not neglect safety training in other branches of the mineral industries, including ore mines, mills, concentrators, smelters, and petroleum and natural-gas operations. In addition, it extended its safety training beyond the borders of the United States for the second successive year, assigning a two-man team to instruct workmen and managers at several Mexican mining centers in first-aid and mine rescue methods.

Other foreign activities of the Bureau were aimed primarily at assuring a continuing inflow from abroad of strategic and critical minerals in which the United States is deficient.

The Bureau collected and interpreted information on foreign mineral developments. Under a continuing agreement with the International Cooperation Administration, it assigned staff members to assist friendly countries with their mineral problems and accepted foreign technologists for specialized training in Bureau of Mines laboratories. Highlights of the year included research in Bureau laboratories on producing ferronickel from Philippine laterites and serpentines; on designing and constructing a pilot plant to be installed in India for drying, briquetting, and carbonizing lignite; and on metallurgical treatment of Peruvian copper ores.

The foregoing outlines only a few activities of the Bureau during the past 12 months. Details of these and other attainments and endeavors during the fiscal year appear in the sections that follow.

MINERALS DEVELOPMENT

The dependence of United States security and rising living standards on advances in science and engineering became more widely apparent in 1957. Minerals research and development are doubly affected by this dependence: (1) demand from diminishing resources can be met only by improved discovery, production, and use technologies; and (2) fulfillment of the promises of new scientific knowledge often awaits development of materials with special properties and in adequate supply. Recognition of this dependence resulted in expansion of minerals research in the Department and Bureau.

National security continued as a major concern; defense-related assignments had high priority and absorbed a substantial part of the overall Bureau effort.

In 1957, Bureau services to the Office of Minerals Mobilization continued through a liaison office that had been established in 1956, staffed by two top members of the Bureau of Mines serving on rotating assignment and two consultants. This full-time liaison group was supported by the Bureau's entire professional staff, as needed, when particular commodities were under study. Twenty reports for which the Bureau of Mines had prime responsibility were completed, in addition to substantial contributions to eight reports for which the Federal Geological Survey had prime responsibility. The Bureau continued as technical consultant to General Services Administration on mineral-supply problems and carried out research for this agency on several occasions.

The Bureau and Geological Survey continued their participation in selecting and administering Defense Minerals Exploration Administration projects to foster discovery and development of strategic minerals.

As a result of previous planning and organizing, it became possible by mid-1957 to schedule a Minerals Yearbook speedup program aimed at bringing about earlier publication of annual editions of this widely used reference.

As part of its work, and in recognition of its leadership in mineral-industries research, the Bureau was permitted to assign staff members to serve on many committees and boards, including those of the American Society for Testing Materials; the American Institute of Mining, Metallurgical, and Petroleum Engineers; the National Academy of Sciences; the American Chemical Society; and the American Standards Association.

Base Metals

The Bureau's applied physics investigations at three of the Nation's largest underground copper mines recorded significant progress toward improved operating procedures. Similar studies will begin at open-pit copper mines; they will contribute substantially to ultimate extraction of ore and conservation of resources.

Investigation of copper occurrences in Washington and Alaska during the year continued. Data on mining methods at copper mines in Arizona and Montana were collected and published. In copper metallurgical studies, favorable results for commercial utilization were obtained from continued research on low-grade and complex ores. Greatest strides were made in treating oxide-copper ores by the segregation process. Moreover, significant progress was made in beneficiation, hydrometallurgical, and other pyrometallurgical studies.

Cataloging lead and zinc deposits, experiments to improve the recovery of lead and zinc in finely sized sulfides and in oxide minerals, and

research on zinc-base alloys all showed notable progress. Advances were made likewise in metallurgical activities concerned with removing cadmium, germanium, and lead from zinc concentrate.

In response to a need for reserve data for long-range and defense planning, detailed compilations of domestic copper-, lead-, and zinc-ore reserves were undertaken by the Bureau.

Compilation of information on domestic mercury resources continued and was expanded to include facts on mining and processing methods and costs at representative mines. Additional laboratory tests were conducted on a complex mercury-antimony ore from Alaska.

Laboratory results on separating magnesium and cadmium in a scrap magnesium-cadmium-aluminum alloy were so encouraging that private industry tested the process on a continuous pilot-plant scale.

Favorable progress was made in research on recovering copper, lead, zinc, and other nonferrous secondary metals from scrap and waste-metal products by vaporization of metals at low pressure, liquation, filtration, and centrifugation of molten metals, electrolysis, and other fundamental techniques.

Four possible methods of recovering several million pounds of tin, plus tungsten, from slag at the Longhorn tin smelter in Texas were devised.

Ceramic and Fertilizer Materials

The Bureau's new phosphate-rock "planer," essentially a continuous mining machine designed for mining inclined, bedded deposits by longwall methods, moved one step farther in its development. Design and construction of a much-improved second model were completed, and the new planer was installed underground in a western mine for testing.

Satisfactory substitutes for strategic muscovite block and film mica continued as the goal of the Bureau's synthetic mica research. A new technique for producing large, oriented crystals of fluorophlogopite mica was investigated, and the effect of composition on mica ceramics made by hot-pressing various synthetic micas was studied. A co-operative agreement was signed with General Services Administration to provide for expanded research by the Bureau on synthetic mica and for monitoring research contracts between GSA and industry. Bureau research under this contract emphasized development of synthetic mica compositions especially suitable for delamination and reconstitution into usable sheets and basic studies of the crystal growth of synthetic mica from melts.

Sampling and evaluation of high-grade clays were continued selectively in accordance with the demonstrable need for assistance to

industry in establishing adequate, dependable supplies of specific types of clay in particular areas.

A new project on the beneficiation of Missouri flint, burley, and plastic fireclays was started, in cooperation with industry, to extend the commercial reserves of these clays on which a major part of the great fireclay refractories industry of the Missouri Valley depends.

Accelerated demand for expanded clay and shale lightweight aggregate for building and highway construction resulted in increased activity by the Bureau in sampling and evaluating expansible materials.

Basic research on carbides, borides, silicides, and nitrides advanced, and the more promising of these materials were evaluated for abrasive and refractory applications. A new project was initiated to obtain basic information on refractory oxides for ultra-high temperature uses, such as jet-engine components.

Construction and Chemical Materials

Bureau contributions to solution of fluorspar-industry problems included a study of acid-grade fluorspar specifications. As a result, the Department revised purchase specifications under Public Law 733 to conform with commercial requirements. Fluorspar deposits were examined by Bureau engineers, and flotation tests were conducted on complex ores from Southwestern and Midwestern States. Research was directed particularly toward flotation methods to permit utilization of fluorspar-barite ore as a source of fluorspar. Progress also was made by the Bureau in its research on recovering fluorine (as aluminum fluoride) from low-grade and siliceous fluorspar ores.

A report was compiled on California asbestos occurrences, and preparations were made for diamond-drilling promising areas. A study of the properties of asbestos was directed toward better understanding of the characteristics that make each variety particularly effective in its specialized uses.

The Bureau continued to accumulate information on the formation and properties of synthetic asbestiform fibers. Progress in this phase of the Bureau's asbestos program was aided by installation of an electron microscope to obtain vital information on the physical structure of the complex fibers.

Substantial gains were made in a nationwide survey of sulfur resources. Meanwhile, laboratory research began on processes to utilize submarginal deposits and byproduct supplies now wasted.

Bureau studies revealed that recovery of lithium minerals from mill tailing can be increased substantially, and further study of this problem was scheduled.

Research was started on methods of improving the water-supply situation of the mineral industry. A series of tests indicated that

contaminated water available in the Salt Lake drainage area was unsuitable for use in flotation processes. Research will continue on the effects of specific contaminants and on treatment methods.

Close cooperation was maintained with industry and with Government agencies involved in the national highway program, particularly regarding information on the capacity of the cement industry to meet program requirements. Studies of current methods of mining and processing mineral aggregates were made at several typical operations.

Bureau physicists, using a unique, high-speed, photographic technique, have developed a revolutionary new theory of how rock is broken by explosives, and this research was extended during the year to include a study of its application in stone-quarry blasting.

A research project on the hydration characteristics of gypsum plaster began during the year and provided fundamental thermodynamic data which may throw new light on the behavior of gypsum in use.

Research was started on the production of high-purity boron and on the determination of its properties and utility.

Ferrous Metals and Ferroalloys

Studies were made on Lake Superior nonmagnetic taconites and on low-grade and complex iron ores in the Southeastern, Western, and Northwestern States and Alaska. A report known as "The Iron-Ore Materials Survey" was published by the Bureau.

In cooperation with industry, the Bureau obtained improvements in blast-furnace efficiency by sizing and agglomerating iron ores and by varying operating techniques. Basic research in high-temperature reactions was completed. A top-fired scrap preheater developed by the Bureau to cut steelmaking costs, was adopted by industry. Work went ahead on utilizing western ores in producing stainless steels. Factors that affect uniformity of steel and the use of rare earths in steel manufacture were investigated.

The use of subgrade domestic chromite resources was explored through studies of chemical, pyrometallurgical, and physical beneficiation methods and production of usable chromium alloys. High-purity ductile chromium and its alloys were supplied to independent laboratories for special observations. High-purity chromium wire supplied by the Bureau was irradiated for experimental use in treating cancer. Results of research on using subgrade domestic chromites to produce chromium and chromium refractories were published.

Manganese oxide pellets of good physical structure and chemical analysis were created experimentally from low-grade manganese ma-

terial from the Cuyuna range in Minnesota, using the Bureau's high-temperature sulfatization process. Reports were published on mining and metallurgical investigations involving western and eastern low-grade manganese ores. Manganese-extractive processes studied included percolation leaching with sulfur dioxide and roasting low-grade ores in contact with mixtures of ammonium compounds, followed by leaching with water.

Molybdenum research was aimed at perfecting a process to produce massive ductile metal by laboratory bomb reduction. Yields exceeding 90 percent of soft ductile molybdenum were obtained experimentally. A study of the application of physics to block caving at the Climax molybdenum mine in Colorado continued, and a Materials Survey on Molybdenum was published.

Bureau of Mines research led to promising improvements in roasting and leaching techniques for nickel-cobalt ore at the United States Government-owned plant, Nicaro, Cuba. A resource study of nickel-bearing laterite in Puerto Rico began in cooperation with the Puerto Rican Economics Development Administration.

Studies of low-cost methods for producing vanadium led to experimental production of high-purity ductile vanadium.

A review of tungsten technology in mining and milling, appraisal of western tungsten deposits, and research to improve flotation and hydro-metallurgical techniques continued as part of the Bureau's program. Results of a basic mineralogic study and on recovering tungsten from tin slags were published.

Light Metals

A process to upgrade domestic bauxite into a material suitable for alum production, developed by the Bureau of Mines, is to be used in a plant being constructed in Arkansas by a large chemical producer. By processing raw material not previously considered usable, the company operation in the area will be prolonged 20 years.

Additional research on developing raw materials for producing alumina included a critical analysis and review of all known processes for obtaining alumina from nonbauxitic materials. Results of the study will be published and used to guide further research.

To advance the conservation and utilization of the limited domestic supply of bauxite, a project was started to devise underground mining methods for increasing recovery at high-grade deposits.

The Bureau expanded its program of magnesium-alloy research to include studies on the vibration-damping capacity of commercial magnesium alloys. This work will establish authoritative data that may lead to selection of magnesium for wider application in uses involving the absorption of vibration-induced stress.

Investigations of titanium-mineral deposits in the United States were started to provide information on future sources of supply for the expanding titanium metal and pigment industries. Deposits in California, Idaho, Wyoming, Colorado, Oklahoma, Texas, Virginia, Maryland, and Alaska were studied, and preliminary beneficiation tests of some of the ores were made.

Under a cooperative agreement with the General Services Administration, titaniferous magnetites from New York and Wyoming were smelted by the Bureau to yield high-titania slag and pig iron. Slag produced in previous experiments was chlorinated to make titanium tetrachloride suitable for reduction to titanium metal.

Hyperpurity titanium metal was made by electrorefining titanium scrap and offgrade sponge. The resultant metal was purer than any available commercially. Samples were distributed for evaluation to laboratories conducting Government research.

An experimental arc-melting furnace capable of pouring 180 pounds of metal was built for casting titanium. The Bureau demonstrated that intricate shapes could be cast in titanium; examples included several 2-inch gate valves and 1½-inch diaphragm valves. These are believed to be the first all-titanium valves made by casting.

Rare and Precious Metals

Solvent-extraction processes developed and tested by the Bureau were adopted in several uranium mills treating ores from the Colorado Plateau. Further progress was made in extracting uranium from South Dakota lignite and thorium from Colorado ore.

A handbook on uranium exploration and production was published to assist prospectors and miners, and preparation and publication of a series on mining methods and costs at various uranium mines were continued to assure dissemination of information on the latest and most efficient mining practices. The Bureau, continuing a contract with AEC, tested more than 15,000 mineral samples submitted by the public and believed to contain radioactive elements.

Research on rare-earth metals went ahead at the Reno, Nev., station. Analytical techniques were emphasized as test conclusions depend upon accurate analyses which are extremely difficult in the case of the rare-earth elements. Analytical methods progressed satisfactorily, and more effort will be spent in developing extraction and refining processes for producing individual rare-earth metals.

At the Northwest Electrodevelopment Laboratories, Albany, Oreg., the Bureau continued to investigate the metallurgy of zirconium and hafnium to reduce production costs and improve the purity and ductility of both metals. Work was done to improve fabricating tech-

niques, attention being given to casting, spin casting, extruding, rotary forming (spinning), and drawing. The first part of a bibliography of the literature on zirconium and hafnium was issued.

Reconnaissance on sources of selenium and laboratory research on ores representing a potential reserve were continued by the Bureau throughout the Western States under cooperative agreement with the General Services Administration. At Salt Lake City, Utah, the Bureau opened a program for recovering selenium and uranium from seleniferous uranium ores. A field test for selenium was developed and described in a publication to aid prospectors.

A private company began building a multimillion-dollar plant in Oklahoma for treating columbium-tantalum concentrate. It will use a separation process developed at the Bureau Albany, Oreg., station.

Seeking to develop additional supplies of beryl to meet renewed demands for beryllium, the Bureau continued research on flotation methods that have commercial promise of recovering beryl from pegmatites of the Black Hills, S. Dak., and Kings Mountain, N. C., areas.

Mine ores and mill and smelter products were surveyed to find and evaluate sources of rhenium.

Miscellaneous Research on Minerals

Bureau scientists and engineers conducted important research on various phases of general mining technology both in Bureau laboratories and in operating mines. These studies included design and development of instruments for obtaining information relating to rock-stress problems, determination of fundamental physical laws governing the breakage of rocks by explosives, basic research on the behavior of caving ground in mining operations, physical property tests of rock types, investigation of methods for detecting ground movement, and design of underground mine openings for maximum safety and efficiency. Research on drilling methods and studies in improving mining methods through abatement of noise and vibration were also parts of the Bureau mining-investigation program.

Fundamental studies through precise measurement of the properties of mineral substances and compounds, important in metallurgical and ceramic technology, were carried on, and the information thus derived was correlated and made available to engineers and scientists developing new metallurgical and chemical processes for treating natural ores and mineral products. Research also was directed toward developing new mineral-dressing procedures and analytical techniques that will give engineers more complete and exact knowledge of ways to win metals and minerals from their ores.

BITUMINOUS-COAL RESEARCH AND RELATED ACTIVITIES

Output of bituminous coal continued to be high and was only 2 percent below that in the preceding fiscal year. The outlook for steadily increasing energy requirements, both at home and abroad, created general awareness of the need for increased research in coal production, distribution, and utilization and resulted in plans for expanding and modernizing this industry. These will prove of great importance to the national economy.

Technologic Research

The Bureau's technologic research on bituminous coal during the year was divided into two general categories: (1) Continuing studies to improve ways by which well-established coal-mining, preparation, and utilization methods could serve industrial development; and (2) exploration of wholly new approaches to coal mining, preparation, and utilization.

Underground coal-haulage systems were studied to provide industry with a sound basis for selecting equipment for use under different typical mining conditions. In another study of eight auger-mining operations, productivity per unit shift was shown to be superior to that by conventional mining.

Bureau coal-preparation research was directed primarily toward improving methods for cleaning fine sizes of coal. As a result of these studies, a method known as feldspar jigging was introduced commercially to the coal industry of this country. Moreover the Bureau's basic work on coal flotation has resulted in important findings concerned with factors of cell design and reagent preparation leading to significant increases in rates of recovering products. Liquids-solids separation methods were studied in efforts to minimize stream pollution from discharges by preparation plants. Equipment analyzed included vibrating screens, cyclone thickeners, and combinations of these, as well as flocculation and vacuum filtration devices.

The utilization of lignite for fuel and chemicals was fostered by the Bureau through development of data on lignite size-reduction characteristics and requirements of power for size reduction. Ways were sought to prevent troublesome freezing of lignite in railroad cars during the winter.

The largest use of coal today is in generating heat and power. Bureau of Mines studies toward achieving greater efficiency in these processes included work on flow patterns of gases and powder suspensions, devising new methods for calculating the temperature of flames,

evaluating the performance of large furnaces used by electric utilities and other industries, and aiding the prevention of air pollution.

Another essential use of coal is to make coke for producing metals from ores. In studies of cokemaking different types of coal and their blends were investigated; work continued on the effects of preheating coal on the quality of coke; fundamental information was obtained on the mechanism and rate of coking; and coals from Kentucky, West Virginia, Pennsylvania, Utah, and Colorado were tested in a continuing survey of the coking properties of bituminous coals.

The Bureau believes that low-temperature carbonization may become a commercially feasible method for obtaining chemicals from coal. Small-scale carbonization assays were made on lignites and coals from 10 Western States, Alaska, and 9 foreign countries, and pilot-plant tests were completed on samples from 5 States and the Philippine Islands. Projects in the Bureau's low-temperature tar laboratories centered on determining variations in tar with rank of coal and properties of these tars, extracting their components, and processing them into more valuable chemicals.

Experts believe that conversion of coal to pipeline gas, liquid fuels, and chemicals will become a necessity in the future, since our coal reserves greatly exceed those of all other fossil fuels. Two approaches are being studied: Treatment of coal with hydrogen (itself derived from coal) and total gasification of coal followed by synthesis of organic compounds from the gas.

In coal hydrogenation small-scale studies showed that small amounts of hydrogen sulfide enhance the activity of iron catalysts. Organometallic compounds were found to be suitable catalysts. A new type of reactor was developed for studying coal hydrogenation during rapid heating and at much higher temperatures. Pilot-plant tests were made to study problems of converting coal to jet fuel, using a process with simpler equipment and considerably lower pressures than those required for the usual hydrogenation process.

Research on the Fischer-Tropsch process (the catalytic combination of hydrogen and carbon monoxide gases derived from coals) included testing steel plates, iron wire, iron-wire screen, and steel wool as catalysts. Researchers ascertained that the poisoning effect of sulfur on iron catalysts depended not only on the kind of sulfur compound but also on whether it was introduced by impregnation of the catalyst before synthesis or by addition to the gas mixture during synthesis.

Pilot-plant studies were begun on a modification of the Fischer-Tropsch process in which hot gas is recycled to remove the heat of reaction. This process now appears technically feasible because of types of catalyst and catalyst pretreatment developed by the Bureau of Mines.

Coal-to-gas research was directed toward developing processes for producing synthesis gas and a substitute pipeline gas, improving auxiliary processes, and gaining a better understanding of the mechanism and kinetics of gasification. Pressure gasification of coal with oxygen and steam was resumed to determine the effect of operational variables.

A new concept in gasification is the use of nuclear heat for the energy of reaction. In cooperation with the Atomic Energy Commission, a conceptual design for a nuclear reactor was completed, and studies were made of component parts and materials.

A semicontinuous pilot plant was operated to develop engineering data on the steam-iron process for making synthesis gas and methane from producer gas. If successful, this process would eliminate use of costly oxygen and, for methane production, use of the methanating reactor also. Direct heating of a low-rank coal-water slurry in externally heated reactors also eliminates oxygen, and experiments with lignite have shown such promise that the projected nuclear-heat process incorporates this concept.

Methods for removing solid and gaseous impurities from synthesis gas were studied. Further facts were obtained on the hot potassium carbonate gas-purification process, using conventional scrubbers. This Bureau method has been recognized in adoption by industry in the United States and abroad.

In its underground gasification tests, the Bureau completed burning the first hydraulically fractured gasification area. A new site was prepared similarly, and porosity within the fractured area was increased by refracture with water at air-injection boreholes. Small-scale electrolinking experiments were made to determine the mechanism of this process.

Bituminous-Coal Economics and Statistics

Bureau of Mines technoeconomic studies of various phases of the bituminous-coal industry have resulted in assembly of information invaluable to industry, to State and Federal Government agencies, and to the Bureau both with regard to the production and utilization of this important energy source and in planning technologic research on bituminous coal. At year's end, plans were underway for broadening the scope of the technical-statistical program and economic research pertaining to coal production and consumption, to competitive energy factors as they relate to coal, and to other economic developments as they concern the coal and coke industries.

So that industry and Government will have adequate information for appraising the position of coal throughout the Nation's expanding economy and rapidly growing energy requirements, the Bureau

has a program for assembling and publishing substantially expanded information about bituminous-coal marketing and distribution. This program will start at the earliest possible date.

Background information was prepared for guidance in solid-fuels mobilization requirements, particularly as regards regional coal availability and coking-coal and coke productive capacity in their relation to steel production and other important uses for coal, including power generation.

EXPLOSIVES AND EXPLOSIONS RESEARCH AND TESTING

Work on Explosives

Continuing its long-range investigation of factors influencing the safety of permissible explosives, the Bureau placed increased emphasis on a study of the relative incendivity of explosives. One early result was demonstration of the role of small concentrations of sodium chloride in reducing this incendivity. As part of the Bureau's regular testing program, out of 31 field samples tested for conformity to Bureau-approved specifications, 2 failed, and the lots of explosives involved were declared nonpermissible. During the year, Bureau researchers made 2,581 tests of permissible and other explosives and of hazardous chemicals.

The potential hazards of a variety of materials, including zirconium and rocket propellants, were also extensively investigated. In connection with propellants and in other studies concerning explosives, the Bureau began studying transitions in explosives from deflagration to detonation. Considerable attention was paid to the rapidly growing use of sensitized, fertilizer-grade ammonium nitrate in open-pit blasting.

Dust- and Gas-Explosion Investigations

Research went ahead on the fundamentals of ignition and flame propagation. Exploitation of new experimental approaches to mechanisms of ignition was begun. Burning-velocity measurements were extended to above-atmospheric pressures, and research continued on fundamentals of gas-burner design and on the production of noxious products by rich flames.

Increasing mechanization of the Nation's coal mines continued to create new safety problems, for example—production of explosive coal dust in rapidly developing entries. Answers to many of these problems were sought at the Bureau's Experimental Coal Mine. Transport and deposition of float dust by mine ventilating systems were studied along with ways to improve or supplement the effec-

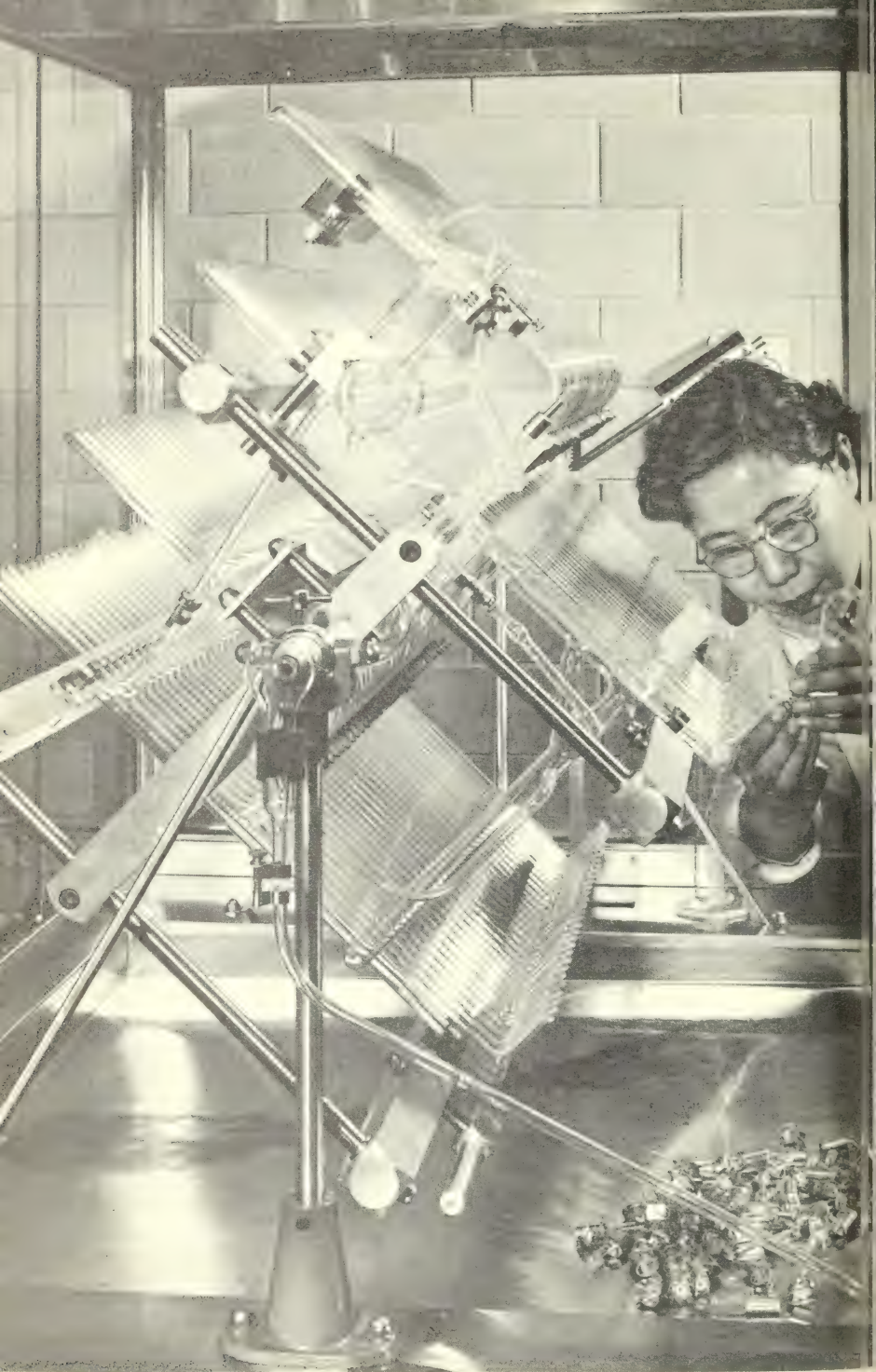


FIGURE 19.—As part of its search for new uses of coal, the Appalachian Experiment Station of the Bureau of Mines at Morgantown, W. Va., employs the countercurrent distribution apparatus in its low-temperature tar laboratory

tiveness of generalized rock dusting for neutralizing the hazards of coal-dust accumulations.

Explosibility characteristics of 56 industrial, mineral, and agricultural dusts were determined. Research was resumed on design factors basic to attenuating dust explosions by venting. Special investigations were conducted on the action of added inert dusts in reducing explosion pressures and on the use of atmospheres with reduced oxygen concentrations below which ignitions will not occur.

Flammability characteristics were determined for a wide variety of gaseous, vaporous, and/or liquid systems of commercial or military interest.

The Bureau assisted Federal agencies, municipal authorities, and industry in investigating fire and explosion disasters. Typical was the one at Luckenbach pier, Brooklyn, N. Y., in December 1956.

ANTHRACITE

Anthracite Research

In line with increased funds granted by Congress, the scope of the Bureau's research activities on anthracite was broadened. New areas of research were investigated, and studies underway were accelerated.

Gasification of anthracite has prospects for development as a large-tonnage market. Past research by Government and private firms was reviewed critically to determine the various processes by which anthracite could be gasified. Commercial-scale tests of two grades of anthracite were underway in a fixed-bed, Lurgi gasifier at the close of the fiscal year and should provide adequate and reliable data for determining the economics of the process and also the adaptability of the coal.

Studies of the use of calcined anthracite were conducted in a coal-company-service foundry cupola. The regular fuel charge for this cupola is 60 percent raw egg-size anthracite and 40 percent +6-inch foundry coke. Calcined anthracite substituted for the entire fuel charge resulted in operation considered completely satisfactory for conditions at this particular foundry and produced metal temperatures of essentially the same degree as those obtained with 100-percent coke charges, at the same fuel: metal ratio.

Laboratory-scale experiments by the Bureau on an agglomerate anthracite metallurgical fuel resulted in producing briquets superior in resistance to impact and abrasion to metallurgical coke. These briquets were composed predominantly of anthracite fines, with small quantities of bituminous coal and coal-tar pitch added.

Laboratory experimentation to define the chemical characteristics of anthracite have indicated that this material can be oxidized under suitable conditions to produce soluble products whose characteristics have not yet been defined.

The anthracite-preparation research program was reactivated, and equipment was obtained to conduct tests on heavy-medium cleaning systems and a further study of high-velocity cyclones as desliming, sizing, and deashing equipment.

The results of preliminary tests with the Bureau-designed pneumatic coal planer warranted extensive design and development work. Industry needs a continuous mining machine for beds pitching between 10° and 25° , and the planer (operating on a longwall system) appears to offer one solution. The study will proceed under the following plan: (1) To establish in a mine of the cooperating anthracite-producing company a longwall system of mining, employing conventional cutting machines and loading with a rigid-blade planer; (2) to develop the Bureau's pneumatic planer; and (3) to fully mechanize the roof-support system. Funds were obligated for purchasing major equipment items for phase (1). Additional items necessary for phase (1) will be purchased with 1958 fiscal year money.

The conveyor system was removed from the Bureau-designed scraper mucking machine and the scraper end tested in sinking a 30° rock slope. The scraper performed well, without alteration, but the work had not progressed far enough for conclusive data to be obtained on performance. A method of caving longwall, advancing, has been designed by the Bureau for productive operation in a new mine, should bed conditions prove favorable when the slope to open the mine has been completed.

The Branch of Mining was assigned a hydraulic mining project, the ultimate objective of which is to establish an underground mining system in which the operations of winning, gathering, transporting, and hoisting mined materials are accomplished by hydraulic methods. As a first step a special nozzle design was created with which it is proposed to concentrate the energy of the water ejected, in jet fashion, some distance in front of the nozzle. In this way the energy will be pinpointed for the most effective action on the solid coal face.

During the year breakers in the anthracite region were sampled, at the request of operators, and the current coal production was analyzed.

Anthracite Flood Control

The Branch of Mine Drainage, headquartered at the Anthracite Experiment Station, Schuylkill Haven, Pa., has as its principal func-

tions the review and evaluation of mine-drainage projects in conformity with the requirements of Public Law 162, 84th Congress, 69 Stat. 352, for making financial contributions by the Federal Government to match expenditures by the Commonwealth of Pennsylvania for such projects.

Thirteen mine-drainage projects were reviewed and, after evaluation, were reported to the Director of the Bureau of Mines for approval by the Secretary of the Interior. The estimated cost of these projects was about \$5,500,000, of which one-half will be contributed by the Federal Government.

Additional drainage projects will be analyzed and evaluated with engineers of the Pennsylvania Department of Mines and Mineral Industries and in consultation with the Federal Geological Survey and representatives of interested anthracite-producing companies. These projects likewise will be submitted to the Secretary of the Interior for approval.

Economics and Statistics

Weekly reports were issued on production. Each month, data on production, distribution, stocks, wholesale mine prices, and hours and earnings were released. Also prepared and distributed were annual reports on production, employment, and distribution. These reports provided industry and others concerned with anthracite reliable information for evaluating the many economic problems of the industry.

PETROLEUM AND NATURAL-GAS RESEARCH

Production, Transportation, and Storage

Information presented in a Bureau of Mines report, combined with the benefits derived from hydraulic fracturing, have resulted in the drilling of 100 new producing wells in the 34-year-old Stevens oil field in Arkansas.

A comprehensive review of methods of core analysis used by the majority of petroleum companies was made by an American Petroleum Institute Pacific Coast District Study Committee; the recommended API procedure will be based in part on the Bureau's method.

Programing for an electronic computer to calculate the effect of the permeability profile of a reservoir on the recovery of oil progressed satisfactorily, and studies of relative permeability measurements and scaled displacement measurements were completed. Research on the productivity of natural-gas wells through laboratory studies to investigate deviations of actual flow from theoretical predictions progressed on schedule.

Engineering work was completed or neared completion on selected fields in Arkansas, California, Kansas, Louisiana, Montana, Oklahoma, Texas, and West Virginia. A report giving analyses of brines from oil-productive formations in Oklahoma was published, as well as one on electrical resistivities of oilfield brines in southern Arkansas and northern Louisiana. Work progressed on studies of trace constituents of oilfield brines.

Research projects on radioactive tracers went forward, and numerous additional gamma logs were made with a new Bureau-designed, transistor-operated logging probe that will provide information for stratigraphic correlations. Also, much interest—particularly from medical-research institutions—has developed in tracerwork related to the design of a Geiger-tube checking device.

Research on surface-active constituents of crude petroleum continued. The stabilities of free porphyrins, purified vanadium-porphyrin complex, and the porphyrin content of a crude oil subjected to irradiation with high-energy X-rays were determined. New methods to separate metal-porphyrin complexes from crude oil were investigated. The effects of high-dosage gamma irradiation on porphyrins and porphyrin-metal complexes were observed by Bureau researchers.

Sequestering and chelating agents were received from a large number of chemical companies for use by the Bureau in experimentally treating water for flooding oil-bearing formations. Laboratory work was completed on the effects of interstitial clays upon the amount of water originally present in oil-bearing sands. A study on the effect of foam produced by surface-active chemicals to increase oil recovery in waterflooding and a series of foam-viscosity tests were completed. Reports were written on clay minerals and permeability of Appalachian oil sands. Analyses and physical property determinations of core samples from Rocky Mountain and Appalachian oilfields continued. A report was completed on the study of mixtures of a non-ionic detergent and citric acid in water injected for secondary oil recovery.

Thirty-eight scientific and engineering reports were finished on research related to primary and secondary petroleum-recovery operations and Missouri River Basin studies.

Petroleum-production engineers of the Bureau of Mines visited 14 petroleum-industry research centers to discuss the Bureau's petroleum-production-research program, with the purpose of strengthening it. The consensus was that the Bureau should expand its basic research and survey type of reporting.

The Bureau presented a report on deliverability tests of gas-storage projects in Oklahoma, Pennsylvania, and West Virginia to the Operating Section, American Gas Association, in San Francisco, Calif. The association has contributed additional funds for expanding the

cooperative study of deliverability of gas from wells in underground storage projects to devise remedial measures for increasing the flow of gas into well bores.

Chemistry, Thermodynamics, and Refining

Major emphasis in research on sulfur in petroleum was placed on a study of the fraction of Wasson, Tex., crude oil boiling from 150° to 220° C. Several individual compounds were identified, and the Bureau proved that sulfur compounds included within this boiling range are largely thiophenic. Four organic sulfur compounds were purified rigorously as reference standards in a related phase of the research. Spectral and other properties for many similar compounds were determined or were obtained through cooperation with other laboratories.

Nitrogen-compound concentrates were prepared from Wilmington, Calif., crude oil by deasphalting, adsorption, and precise distillation techniques, preparatory to identifying individual compounds. Two organic nitrogen compounds were purified as reference standards. Satisfactory purity of compounds was close to achievement for several others.

Thirty-six compounds containing sulfur, nitrogen, oxygen, or fluorine and hydrocarbons of immediate or potential importance in petroleum technology were studied in the Bureau's thermodynamics laboratories at Bartlesville, Okla. Such properties as heat capacity, heat of combustion, vapor pressure, and heat of vaporization were measured precisely. On compounds for which measurements were completed, experimental data were translated into wide-range and universally useful thermodynamic functions. The excellence of thermodynamics research at Bartlesville was recognized internationally when a staff member was invited to speak on calorimetric methods for determining the purity of organic compounds at an international symposium in Amsterdam, Netherlands.

Analyses were completed for 274 domestic and foreign crude oils, including 14 from important Middle East fields. A comprehensive report by the Bureau containing analyses of crude oils from 470 of the largest fields in the United States soon will be published and will be a major contribution to petroleum literature.

Specialized analytical work on crude oils and their fractions progressed under agreements with the Air Materiel Command and the Air Technical Intelligence Center.

Some work was done on diesel-type ignition of pure hydrocarbons, using the constant-volume combustion apparatus developed by Bureau scientists. Current and previously obtained autoignition data

were being correlated to develop reliable relationships between ignition reactions and conditions of combustion.

Also continued were surveys to define the quality of motor gasoline and aviation, diesel, and burner fuels being marketed throughout the Nation.

Research on utilization of gasoline and distillate fuels was directed mainly toward investigation of the basic causes of instability, with emphasis on studies of the stability effects of additives and minor constituents of fuels and of oxidation under controlled conditions. Promising results were obtained in developing accelerated aging tests, using both X-ray and ultraviolet irradiation techniques.

Twenty reports of the Bureau's chemistry, thermodynamics, and refining work were prepared for publication. These are additional to many special reports supplied cooperators and supporting Government agencies.

Research to relate the composition of internal-combustion-engine exhaust gases with fuel composition and engine operating conditions was continued at the Petroleum Experiment Station, Bartlesville, Okla., as cooperative work with the United States Public Health Service on air pollution. Exploratory engine tests, using several fuels representing typical gasoline blending stocks, indicated no gross differences in exhaust-gas composition; however, potentially significant differences were observed in minor constituents in concentrations up to 5 percent. Much effort was put into developing exhaust-sampling equipment and techniques, and, in cooperation with the Coordinating Research Council, of a gas chromatographic analysis method. Gratifying progress was made in both these essential phases of the research.

Petroleum and Natural-Gas Economics

The outstanding event of the year affecting the worldwide petroleum situation was closing of the Suez Canal in November. This action necessitated complete rearrangement of world supplies of crude petroleum. Data provided by the Bureau in its regular reports on crude-oil production, stocks, refining, and demand for refined products in all parts of the world proved essential in effecting this rearrangement. Also, the Bureau's forecasts of market demand for crude oil in this country were instrumental in getting the oil-producing States to raise their allowables and production to meet the sharply higher demands imposed by the Middle East crisis.

Preparatory work was done on proposed additional projects, and several minor improvements were made in regular reports. The Bureau proposes to start these projects in fiscal 1958:

1. Obtain better statistics on crude-oil production through the cooperation of State agencies.

2. Improve surveys of refinery capacity by obtaining more detailed information on processing equipment.
3. Explore possibilities for reporting production and capacity to produce petrochemicals.

OIL-SHALE RESEARCH

After the shutdown of all development work by the Bureau on the Naval Oil Shale Reserves at Rifle, Colo., in June 1956, oil-shale investigations were confined to laboratory work at the Laramie, Wyo., Petroleum and Oil-Shale Experiment Station.

Laboratory Research

Work at the Laramie laboratory was carried on under three main headings: Constitution of oil shale and analyses, conversion of oil shale and products, and characterization of shale oil and spectrometry.

Nearly 5,000 oil-yield determinations were made on cores and cuttings from Colorado and Utah shales. Some of these results were described in a recent Bureau publication.

Studies of the constitution of kerogen from Colorado oil shale continued along several lines: Determination of low-temperature thermal extracts, reduction and decarboxylation of kerogen acids, and fractionation of kerogen acids by partition chromatography and instrumental analysis.

A paper, Hydrogenolysis of Colorado Oil-Shale Kerogen, was readied for publication.

Although there were no retorting experiments during 1957, considerable progress was made in studying the physical-chemical properties of calcined oil shale and converting the kerogen of oil shale by bacterial action.

Laboratory work on the characterization and analysis of fractions of oil from the N-T-U retort advanced, and similar work on oils from the entrained-solids retort was almost completed.

A spectrometric group devoted considerable time to determining the types of nitrogen compounds in N-T-U gas oil and interpreting kerogen spectra. Three papers concerning spectroscopy and shale oil were published during the year.

HELIUM

Production and shipment of helium by the Bureau of Mines established new records in 1957. Primary helium output reached a new peak of 242,926,632 cubic feet, and shipments totaled 282,015,442

cubic feet. The difference between production and shipments was made up by withdrawing and repurifying helium that had been produced and then stored in the Cliffside field in previous years when output exceeded demand.

The Federal Government continued to use directly about 75 percent of the helium produced by the Bureau of Mines, and most of the remainder was employed by private industry on Federal defense contracts. Smaller, but important, quantities were consumed in hospitals and research.

Demands for helium continued to increase throughout the year, and the Bureau was unable to meet all requirements, despite record production and shipments. It was necessary to return to an informal allocation system early in the year to assure that the more important defense and medical needs were fulfilled in preference to less essential balloon and advertising requirements. Federal and private

FIGURE 20.—Part of the new construction at the Exell, Tex., helium plant of the Bureau of Mines is shown in this photograph. The expansion program at Exell was completed in fiscal year 1957.



helium users and private helium distributors cooperated with the Bureau of Mines in making this system work. Consequently, all defense and medical requirements were met, but helium deliveries for non-defense uses were curtailed.

The Bureau of Mines made considerable progress during the year in improving the helium supply-and-demand relationship.

A contract was awarded in September 1956 for building additional helium-production facilities at the Exell, Tex., plant. The enlargement was virtually complete at year's end. The first new units, representing an additional capacity of about 50 million cubic feet annually, began operating June 2. This new capacity became available too late to relieve the helium shortage in fiscal year 1957 but presages major relief in 1958.

When the new Exell facilities become fully operative, they will produce approximately 150 million cubic feet annually and thus raise the overall annual capacity at Exell to 240 million cubic feet. A further increase in capacity will come later through modernization and revision of equipment in the old portion of the plant.

Improvements also were made at the Bureau's other helium plants. The water system at the Navajo (Shiprock), N. Mex., plant was changed substantially to assure a more reliable supply to sustain the high level of production attained by processing helium-bearing gas from the nearby Hogback field. At the Otis, Kans., plant, additional helium-bearing gas was made available for processing when the Shaffer field was connected to the gas system supplying the plant.

Plans advanced for designing and installing a new combination helium production-nitrogen removal unit at the Amarillo, Tex., plant. This unit not only will add to the helium-production capacity but also will improve the heating value of residue gas from the plant. At present, the residue gas is salable only for use in a local smelter, and the output of the Amarillo plant is frequently affected by smelter operations. During World War II it was necessary to waste some of the residue gas to the atmosphere to sustain the necessary high level of helium production at Amarillo. The new unit will free the plant from depending upon a single sales outlet for the residue gas.

Fifteen additional railway helium tank cars were ordered for delivery in September 1958. When these cars are received, the cars in the Government pool operated by the Bureau of Mines will total 122.

These improvements and additions will enable the Bureau of Mines to handle the estimated helium requirements in the immediate future, but the growing helium demand is expected to exceed the capacity of existing facilities before 1960. Consequently, the Bureau of Mines continued its studies of the helium supply-and-demand relationship from a long-range viewpoint.

The wastage of large quantities of helium when unprocessed helium-bearing natural gas is consumed in fuel markets is a matter of increasing concern. If this wastage continues unabated and helium use increases as expected, the known helium resources of the United States will become inadequate to meet all demands beyond 1975-80. The Bureau of Mines is working with other interested agencies in developing a long-range Government helium-conservation policy in efforts to forestall this situation.

The Bureau of Mines continued to sample and analyze new natural-gas occurrences during the year to determine their helium content. No significant new sources of helium-bearing gas have been found since 1943.

The Bureau also continued its modest research program aimed at increasing the overall knowledge of the properties and characteristics of helium-bearing natural gases and methods of extracting helium from them. This work included a study of factors affecting hydrogen adsorptive capacities of activated charcoal and synthetic silicates, and phase relationships, dewpoints, and compressibility factors of selected gases.

In another activity, the Bureau supplied technical advice and appraisal to the Navy and the Bureau of Standards in a study of the feasibility and cost of producing and shipping liquid helium; the Bureau expects to take a more active part during the 1958 fiscal year.

HEALTH AND SAFETY ACTIVITIES

The Bureau's activities for improving safety and health conditions in the mineral industries were modified to cope with rapidly changing methods, practices, and equipment.

Safety education and training programs continued to be emphasized as heretofore. More study and attention were provided for the special problems of roof support, exposure to atmospheric dusts, fire and explosion hazards in coal mines, and radioactive exposures. Investigations of other hazards were continued, with recommendations to eliminate them. By inspection of coal mines and enforcement of the Federal Coal Mine Safety Act, the Bureau endeavored to improve safety conditions, but two major disasters resulting in 42 fatalities occurred during the fiscal year.

Work on Primary Hazards

Roof falls caused 63 percent of the 1956 coal-mine fatalities compared with 58 percent in 1955. A new campaign was inaugurated in cooperation with other agencies, in efforts to bring this hazard

under better control. Such a concerted effort was effective in underground noncoal mines in 1955, and its influence is still being felt.

Bolting continued to control coal-mine roofs effectively. Of 245 roof-fall fatalities in bituminous-coal mines in 1956, only 4 were attributed to failure of bolted roof, compared with 6 in 1955, yet the use of roof bolts had increased approximately 5 percent.

Laboratory and field studies were carried on by the Bureau to determine the basic principles of mine-roof support and to increase the effectiveness of roof bolting. Efforts to systematize the use of compression pads and other warning devices, tests of new types of bolts, and centrifugal studies of rock specimens continued.

Testing Equipment

The continually increasing mechanization of coal mines was reflected in the Bureau's mounting workload. Trends in mining methods were discernible in analyzing the list of approved equipment. The change to continuous mining machines persisted with a resultant increase in the number of bridge or "piggyback" conveyors and elevating conveyors. The increased approvals by the Bureau of auger-type machines may indicate a swing to this type of equipment for low-coal mining.

The Bureau's approval schedules for fire-resistant conveyor belts and for generalized mine lighting added considerably to work throughout the year. A photoflash unit and an explosion-proof floodlight were developed for underground photography.

Interest in diesel-operated equipment for noncoal mines prompted a seminar on diesel problems conducted by the Bureau in Denver, Colo., with representatives from 10 States and 3 foreign countries.

During the year 118 approvals and 145 extensions of approval were issued under 12 schedules. Approvals were granted for mining machines, loading machines, shuttle cars, pumps, wet rock dusters, compressors, fans, drilling machines, power units for mining machines, distribution boxes, generalized lighting systems, diesel tractors with shovel, an electric shaft shovel, a dehumidifier, a splicebox, a pan transformer, a photoflash unit, a diesel traxcavator, and a 10-ton diesel locomotive.

Flame-resistance tests were run on 20 cables and 62 conveyor belts; a belt was subjected to a friction test. Damage-resistance tests were run on 8 cables, 3,095 explosion tests were made in natural gas-air mixtures, and 103 compartments were inspected and tested.

Seven drill-dust collectors for coal-mine use were approved, and 0 extensions of approval were granted. The Bureau's second Experimental Coal Mine, the site of these dust-collector tests, was enlarged or other studies of dust and ventilation.

One new approval and 51 extensions of approval were granted for respiratory protective equipment, including gas masks, supplied-air respirators, dust respirators, and nonemergency gas respirators. Test equipment and tentative requirements for paint-spray respirators were prepared.

Insistent requests were made to the Bureau of Mines by users and manufacturers of respiratory protective devices to broaden its respirator-approval system to include radioactive aerosol respirators. The Bureau agreed, and it will construct laboratory and office space for the radioactive aerosol testing. An Advisory Committee on Respiratory Protection Against Radioactive Materials was formed, to consult with personnel of the Bureau of Mines on developing requirements for testing and approval. Membership of this committee includes representatives of the Atomic Energy Commission, Atomic Energy Commission Contractors, Industrial Hygiene Foundation, Industrial Medical Association, Industrial Safety Equipment Association, and the United States Public Health Service.

Health

The Bureau's program to promote more healthful working conditions in the mineral industries emphasized studies of hazards that may be created by modern technology.

Upon request of the Committee on Education and Labor, House of Representatives, testimony was presented on bills regarding health and safety inspections and investigations in metallic and nonmetallic mines and quarries. Discussions continued with the United States Public Health Service regarding a much-needed study to determine pulmonary disability among American coal miners. Tentative plans also were formulated to study radioactive exposures in uranium mines; to investigate silicosis hazards in metal mines; and to conduct research on effectiveness of respiratory protective equipment against the newly developed and highly toxic materials now being used in increasing amounts in industrial and military operations.

During the year 19,046 gas samples were analyzed, including 18,097 taken during Federal coal-mine inspections. Others came from sealed fire areas in coal mines, metal and salt mines, tunnels under construction, tests of diesel-powered equipment in underground use, tests of respiratory protective equipment, and miscellaneous field and laboratory studies.

Field studies of diesel equipment were carried on in several mines and tunnels. Experiments were made to find fire-resistant substitutes for flammable petroleum hydraulic fluids commonly used in mining machines.

Possible hazards from mineral dusts were assessed by X-ray diffraction and spectrographic methods. More than 550 samples of air-borne dust were examined to determine concentration and particle size. Dust-sampling equipment safe for use in gassy mines was developed, and 10 persons were trained in the sampling, counting, and sizing of air-borne dusts. On request, the Bureau conducted periodic dust and ventilation surveys during construction of the Genesee Tunnel project in Connecticut.

Ventilation surveys by the absolute pressure method were made in three mines to demonstrate the advantages of this method. These field data were analyzed with the Bureau's electric analogue, which continued to arouse interest, being demonstrated to 54 engineers during the year. Particular attention was given to studies of ventilation in coal mines using continuous-type mining machines and to the feasibility of ventilating coal mines without using doors.

Future programs include studies of exposure of workers to dusts in a representative segment of the coal-mining industry, of dust-control practices in metal mining and tunneling, of dust production and control on continuous-type coal-mining machines, of air conditioning in deep, hot mines and heat-tolerance and the concept of effective temperature in respect to mining, of the type of airflow—whether streamline or turbulent—and resistance factors in coal mines.

Safety Education

Experience of the Bureau has shown the value of safety training courses in reducing accident rates, partly by promoting safety consciousness but more so by giving officials and workmen the advantage of research findings on hazards and ways of guarding against them. The Bureau intensified production of motion pictures to be used in safety-training classes during the past year.

In round numbers, 17,000 persons completed the Bureau's accident-prevention course for coal miners and supervisors, raising the number trained since 1947 to 195,000. Records prove that the greatest improvement in accident rates at mines comes when every official and workman has taken this course. Thus, the Bureau placed additional emphasis on 100-percent participation. Bureau personnel continued to give similar accident-prevention courses at mines and plants in other branches of the mineral industries.

By the end of the fiscal year, 1,912,000 persons had taken the Bureau's first-aid course, and 109,700 had taken its mine rescue course since 1910. The Bureau stimulates interest in these activities by sponsoring and contributing judges and other officials to local, State, and national contests and by sponsoring the Holmes Safety Association, a national organization whose local councils and chapters pro-

vide excellent forums for discussing the causes of accidents and ways of preventing recurrences.

Bureau representatives investigated dust explosions in industrial plants and assisted in preparing codes and standards designed to prevent such explosions.

Accident Analysis

Analysis and tabulation of injury and related employment records continued as useful guides for developing better programs to prevent accidents in the mineral industries. In addition to the regular industry reports, special tabulations were prepared for State and Federal agencies, trade associations, labor unions, and others.

Industries covered included coal mining, coke production, quarrying, metal and nonmetallic mining, metallurgical operations, and petroleum and natural-gas production and refining. A revised form, used for the first time to classify and tabulate causes of injuries in the metal- and nonmetallic-mining industries, will enable the Bureau to compile severity as well as frequency rates for them.

The 32d National Safety Competition and four other safety contests were conducted by the Bureau; approximately 1,500 mines, quarries, and plants participated. Some 2,000 certificates of accomplishment in safety were presented to workmen and supervisors at winning plants.

Control of Fires in Inactive Coal Deposits

At the end of the fiscal year, the Bureau had controlled or was combating 63 of the 190 known fires in coal deposits not now being mined, 36 on the public domain and 27 on private property. Coal reserves conserved under this program since the Congress first appropriated funds for it in fiscal year 1949 now total an estimated 268 million tons.

Eight fire-control projects were completed in fiscal year 1957, five on the public domain and three on private property, and work proceeded on eight others.

Future plans include necessary maintenance work on completed projects and the start of new ones, in order of urgency, to the extent appropriations permit. The Government pays the full cost of controlling fires on Federal land and requires local contribution of half the cost of controlling those on private property.

Coal-Mine Inspection

For the fifth full year coal-mine inspection work was carried on under the Federal Coal-Mine Safety Act. Besides title I, authoriz-

ing the Bureau to enter and inspect coal mines, report on hazards, and recommend (but not require) their correction, it includes in title II specific enforcement provisions designed to prevent explosions, fires, inundations, and man-trip and man-hoist accidents in mines regularly employing 15 or more men underground.

The Nation had approximately 9,458 active coal mines in 1956, including 1,541 title II mines (more than 14 underground employees), 6,693 title I underground mines (14 or fewer underground employees), and 1,224 strip mines. At the end of fiscal 1957 Bureau personnel assigned to coal-mine inspection and related duties included 253 coal-mine inspectors, 23 engineers, and 9 coal-mine inspectors (electrical).

During the year 3,507 regular inspections were made of coal mines subject to title II, 38 of them jointly with State inspectors under State-Bureau cooperative agreements provided in the act. In addition, 1,336 inspections were made to determine whether previously cited violations of mandatory provisions had been abated.

Federal inspectors observed 8,998 violations of the mandatory provisions, many of which were corrected immediately and thus required no formal action. They issued 1,414 notices setting a reasonable time for abating dangers, 375 granting time extensions, and 1,300 certifying that dangers had been totally abated.

During the year 83 orders were issued requiring withdrawal of men from all or part of 57 mines—54 orders at 43 mines because of imminent danger and 29 at 15 mines because of failure to abate violations within a reasonable time. By comparison, 112 withdrawal orders were issued at 63 mines during the previous year.

Orders were issued classifying as gassy eight mines previously considered nongassy. The Federal Coal-Mine Safety Board of Review, an independent agency, denied one appeal by an operator for annulment of a gassy-classification order and revised another order to apply only to that section of the mine in which methane (explosive gas) was detected. The former was appealed by the operator to the United States Court of Appeals, but the appeal was denied.

Federal inspectors and engineers also made 7,331 inspections of smaller title I mines (including 875 strip mines), 554 electrical, ventilation, dust, blasting, and related surveys, and 670 investigations of fatal and serious nonfatal accidents, mine fires, gas and dust ignitions, and miscellaneous conditions.

Two major explosion disasters (1 causing 5 deaths, the other 37) occurred during the fiscal year. The first of these, in January 1957, broke a 26-month disaster-free period in the domestic coal-mining industry. Preliminary reports show 444 coal-mine fatalities in calendar year 1956, compared with 417 in 1955; the fatality-frequency

rate per million man-hours exposure also increased from 1.04 in 1955 to 1.08 in 1956.

FOREIGN ACTIVITIES

In the 1957 fiscal year the Bureau intensified its foreign activities on projects and services designed to assure a continued inflow of strategic and critical minerals needed to fill the gap between domestic production and consumption and to provide a reserve stock adequate for sustaining a possible emergency shortage. In collecting information for this and other uses of the Department, the Bureau's liaison office processed and distributed more than 31,000 foreign service dispatches from the Department of State. Those pertinent to the program were combined with technical and economic information from other sources, evaluated, and analyzed.

Within staff limitations, information on foreign mineral resources, exploration, investments, controls, development, production, processing, transportation, consumption, marketing, and international trade was widely distributed. One foreign government requested and received guidance in drafting its natural resources law governing minerals and hydrocarbons and designed to attract the investment of national and foreign private capital on reasonable and equitable terms.

The Bureau also gave technical aid to underdeveloped countries and advanced training to foreign specialists. These activities have strengthened our sources of essential mineral supplies and contributed to expansion and protection of investment by private American capital in developing foreign mineral resources.

Services to Government and Industry

Requests relating to foreign mineral matters from Federal agencies, foreign governments, consultants, educational and research institutions, and companies seeking new investments in the foreign minerals field and new markets for machinery and equipment were answered by publications of the Bureau, 1,116 personal interviews, 1,965 letters, and 2,123 telephone calls, in addition to the preparation of detailed special purpose reports. The Bureau cooperated with the Department of State in appraising and improving foreign service reporting.

The year was notable for the intensive exploration activity of mining and petroleum companies, particularly in Latin America, Canada, Africa, and Australia, in search of new mineral resources in general, but with special emphasis on petroleum, bauxite, iron ore, nickel, manganese, chromite, and rutile. This is normal to the rapid expansion of American investment in developing mineral industries abroad.

Technical Assistance

The Bureau maintained its program of technical assistance throughout the year under its continuing agreement with the International Cooperation Administration, with engineers assigned to 17 projects in 13 countries: Afghanistan (2), Brazil, Colombia, Cuba, Egypt, Israel (2), Indonesia, Liberia, Mexico, Nepal, Pakistan (2), Peru, and the Republic of the Philippines (2). The projects included 5 in metallurgy, 4 in coal mining and technology, 5 in metal and nonmetal mining, 1 of combined responsibilities, 1 in chemical engineering, and 1 as an adviser in the proposed establishment of a government mining agency. Three projects were terminated during the year, 2 were interrupted by the Suez crisis, and 2 were newly started.

The educational program inaugurated last year, utilizing Bureau motion pictures depicting safety practices and various mining and metallurgical operations continued successfully.

A metallurgical project in Mexico was supplemented by assignment of a two-man Bureau team for 4 months of instruction to miners and managers at several mining centers in first-aid and mine rescue practices. A Bureau metallurgist assigned to Peru, in addition to his regular duties, campaigned successfully for establishment of a metallurgical department at the National University of Engineering.

Under the technical assistance program, research was conducted at Bureau field stations at Albany, Oreg., on the production of ferro-nickel from Philippine laterites and serpentines; at Denver, Colo., on designing and constructing a pilot plant to be installed at Neyveli, India, for drying, briquetting, and carbonizing lignite; and at College Park, Md., on the metallurgical treatment of copper ores from Sin-Chao, Peru.

Foreign Trainees

Training of mineral technologists from abroad at Bureau laboratories increased one-third over fiscal 1956. Of the 36 technologists receiving training, 28 completed their assigned studies, and 8 remained at the end of the year. The trainees came from 14 countries: Afghanistan, Formosa, Greece, India, Indonesia, Iran, Iraq, Kenya, Korea, Mexico, Peru, the Republic of the Philippines, Thailand, and Yugoslavia. Training emphasis, accorded to the major needs of the countries represented, was on mining and metallurgy, the production and efficient utilization of fuels, and health and safety practices. The Bureau estimates it will accommodate about 35 foreign trainees during the 1958 field year.

RIVER BASIN ACTIVITIES

Water-supply and drainage-control problems of the Nation continued to increase daily in number and complexity during the year, lending additional importance to the activity and cooperation among Federal, State, and private agencies to seek their solution and to promote water conservation. Problems regarding inundation of mineral resources, pollution, water supply, and mine drainage were of increasing concern to the Bureau.

Mine-drainage and flood-protection problems in the Susquehanna Basin, especially in the Pennsylvania anthracite area, were studied in cooperation with the Commonwealth of Pennsylvania and the United States Corps of Engineers.

Special reports were prepared concerning the mineral industry in proposed Federal and non-Federal water-development project areas. The Bureau supplied professional mineral-engineering consulting services on preparation of the United States Department of Agriculture's Interim Watershed Protection Handbook; a possible corridor for Canada to a free port through southeastern Alaska; minerals in small watershed developments; and minerals in or near proposed reservoir sites. In the last category, where significant mineral deposits faced inundation and cessation of production, economic means were found to provide both continued mineral production and water conservation.

During the year investigations and reviews of reports for other Federal agencies included 32 for the Corps of Engineers, 31 for the Federal Power Commission, 6 for the Bureau of Reclamation, and 18 for the Department of Agriculture.

Missouri Basin Project

Using special funds appropriated annually for the Missouri Basin program, the Bureau of Mines completed three technical reports for Federal and State agencies, covering several phases of the mineral industry and its relation to water conservation and development. Fourteen proposed reservoir sites were examined and reported on for the Bureau of Reclamation. At the Oregon Basin site, where inundation of oil wells was involved, engineering recommendations were made for appropriate installation of causeways and dikes to permit continued petroleum production, coincident with operation of the proposed reservoir.

Metallic- and nonmetallic-mineral studies concerned source investigations, utilization, and industrial feasibility. Part I of a two-part report on the phosphate industry of Montana was released to the cooperating agencies for use in planning work. Several manuscripts involving mineral raw materials for various industries were being

prepared at year's end. A study was begun in cooperation with the Bureau of Reclamation on properties of various clays that might be used to reduce the cost of lining canals and increase their efficiency.

Studies of pegmatites in the Black Hills of South Dakota were completed, and a report was scheduled for early release.

MINERAL ECONOMICS

Providing a background for developing long-range and mobilization mineral policies of the Federal Government, the Bureau made statistical analyses of many mineral commodities to estimate the quantitative effects of alternative Government policies affecting mineral industries.

Supply-and-demand responses to changes in prices, gross national product, industrial production, relative prices of substitutes, stocks, investment, and to technologic developments were statistically evaluated for the United States and other countries. More than 100 demand situations for fuels were analyzed.

The cost to taxpayers, consumers, and related industries and probable benefits to the mining and metallurgical industries were determined for tungsten, fluorspar, asbestos, and columbium-tantalum, purchasable by the Federal Government under Public Law 733 (84th Cong).

An analysis of the energy sector of the national economy was undertaken to update an earlier Bureau of Mines study. The latest analysis was a comprehensive study of energy flows from energy-producing industries to all energy-consuming industries, based upon the 1954 Census of Manufactures and Census of Mineral Industries. The information was used to organize an interindustry model of energy flows to give for the first time, a complete and balanced picture of the energy sector of the economy.

Foreign trade patterns, tariff and quantitative restrictions on mineral commodities, and other pertinent factors were analyzed in connection with negotiations under the General Agreement on Tariffs and Trade. The effects on United States and foreign prices, outputs and consumption of proposed tariff changes, and barter goals for individual mineral commodities were studied. The overall situation of imports and exports and various Government actions and transportation cost changes as they affected the trade position of mineral industries were under continuing analysis and review during the year.

The effects of Federal and State taxation on mineral enterprises and their finances continued to be studied. Estimates were made of benefits received under the Federal programs of accelerated tax amortization. To estimate the effects of proposed changes in mineral-taxation laws, studies of the profitability of the mining industry, using income-tax data as the primary source, were prepared.

PUBLIC REPORTS

In carrying out the Bureau's responsibility of making its findings widely available, 595 manuscripts were prepared for publication during the fiscal year. They included 7 bulletins, 193 chapters and 3 bound volumes of the Minerals Yearbook, 1 miners' circular, 1 handbook, 87 reports of investigations, 35 information circulars, 210 speeches and journal articles, and 58 miscellaneous reports. Their preparation involved writing and editing more than 26,000 pages of text.

Showings of films from the Bureau's free loan library of industry-sponsored technical-educational motion pictures totaled 239,020, an alltime high, reflecting increasing demand, particularly from schools in the 48 States, Alaska, Hawaii, and the District of Columbia. Recorded attendance at group showings was 14,052,929, and an estimated additional 36.5 million persons saw the films on noncommercial television programs.

Three of the Bureau's motion pictures received awards for excellence during the year at film festivals in the United States and abroad.

During the year two new film subjects were added to the Bureau's library, The Petrified River—the Story of Uranium, and Idaho and Its Natural Resources. At year's end 6,297 prints were on deposit at Pittsburgh, Pa., and at cooperating subdistributing centers throughout the country, a net gain of 116, but the demand for prints continued to exceed the supply.

ADMINISTRATION SUMMARY

Continuous analyses of management practices and procedures resulted in strengthening the Bureau's ability to conduct expanding programs designed to contribute to the national security and well-being.

An Office of Management Analysis was organized to give staff assistance to the Deputy Director in general management of the Bureau; in programing plans of action and providing the leadership for bureauwide management improvements; and stimulating participation in and coordinating management-improvement projects at all levels of operation.

Organization and Management

A new Health and Safety district office was established at Norton, Va., to relieve the workload of District C, headquartered at Mount Hope, W. Va. Coal production in District C, 1 of 8 Health

and Safety districts before the organizational change, represented about 50 percent of the Nation's total. About 40 percent of the Federal coal-mine inspectors and engineers had been assigned to District C.

A committee composed of representatives of the Office of the Secretary and the Bureau was established to review management practices bearing upon organizational effectiveness. In addition, the Director appointed a committee to review and recommend procedures concerning the production and distribution of publications and the distribution of motion pictures. Reports from these committees will be considered for action in the 1958 fiscal year.

A Bureau representative was appointed to serve on the Departmental Automatic Data-Processing Committee.

Substantial progress was made toward completing the Bureau of Mines Manual.

The use of administrative orders and business orders for releasing bureauwide continuing instructions was discontinued.

Property

During the year efforts were concentrated on reducing the inventories of excess property at various field installations to a minimum. This resulted in redistribution of valuable equipment and supplies to points of greatest need and has become a continuing process of culling unused items and circularizing all other Bureau activities so as to place them where they may be needed most.

Progress was counted in reducing expendable materials in formal storerooms throughout the Bureau. As a result, numerous slow-moving items were eliminated from stock, with satisfactory reductions in the overall inventories.

The number of locations of imprest fund cashiers was increased from 19 to 26. This increase, plus the expanded use of monthly charge accounts, enabled the Bureau to reduce substantially the number of purchase orders.

Simplified procedures for property accounting were prepared in Manual form and were distributed to employees. At year's end additional Manual revisions were being prepared for early publication.

Finance

During fiscal year 1957 reports were completed and submitted on 2 surveys made during fiscal year 1956 regarding 2 aspects of financial operations in the Bureau.

The report on the survey of the accounting system recognized several problems concerning operating personnel, and recommendations

were made that will facilitate management of the Bureau's financial affairs.

Information gained from a bureauwide study of practices at field installations in the use and cost of common services, such as shops, and the methods employed in distributing these costs and administrative expenses, will prove beneficial when recommendations in the report are put into operation.

The Branch of Finance participated in studies on problems concerning the processing of Bureau publications and distribution of motion pictures.

Bureau of Mines funds, including direct appropriations, prior balances available, reimbursements, advances and transfers from other Government agencies, proceeds from helium operations, and contributions from non-Government sources, totaled \$52,560,428. Of this amount, \$35,376,261 was obligated, leaving an unobligated balance of \$17,184,167. Approximately half of this was represented by available-until-spent funds approved by Congress for the anthracite mine-drainage program. A recapitulation at the end of the following tabulation shows the approximate amounts and sources of unobligated balances.

Funds available to the Bureau of Mines for fiscal year 1957, by source of funds

| | |
|---|----------------|
| Direct appropriation----- | \$22, 197, 050 |
| Prior year balance available----- | 17, 952, 732 |
| Expired funds available for disbursement----- | 106, 804 |
| Less transfers and returns----- | —99, 653 |
| Reimbursement from other Government agencies----- | 357, 700 |
| Advances and transfers from other Government agencies----- | 5, 662, 854 |
| Proceeds from helium operations----- | 5, 489, 540 |
| Contributions to trust funds from non-Government sources----- | 893, 401 |
| Total----- | 52, 560, 428 |

Obligations incurred by the Bureau of Mines in the fiscal year 1957, by appropriation

| | |
|---|----------------|
| Conservation and development of mineral resources----- | \$16, 176, 021 |
| Health and safety----- | 5, 288, 181 |
| Construction----- | 2, 424, 824 |
| General administrative expenses----- | 1, 013, 507 |
| Anthracite mine drainage----- | 328, 645 |
| Consolidated working funds----- | 2, 808, 642 |
| Appropriation transfers----- | 2, 299, 098 |
| Economic and technical assistance, defense support, Asia and Pacific, other than Formosa and associated States of Cambodia, Laos and Vietnam, executive (transfer to Interior)----- | 410, 685 |
| Technical cooperative, general, executive (transfer to Interior)--- | 170, 096 |
| Mutual defense financing, defense support, finance and technical assistance, Europe, executive (transfer to Interior) April 4, 1948-54----- | —274 |
| Defense support, Asia (transfer to Interior)----- | 44, 872 |

| | |
|--|------------------|
| Defense support, Near East, Africa, and South Asia, executive (transfer to Interior) 1955----- | -\$2, 985 |
| Southeast Asia and Western Pacific, executive (transfer to Interior) 1955----- | -295 |
| Technical assistance to American Republics and non-self-governing territories of Western Hemisphere, executive (transfer to Interior)----- | -161 |
| Technical cooperation, general, executive (transfer to Interior)--- | 81, 914 |
| Administrative expenses, section 411, Mutual Security Act, executive (transfer to Interior)----- | 21, 140 |
| Development and operation of helium properties----- | 3, 438, 648 |
| Contributed funds----- | 873, 703 |
| Total obligations incurred----- | 35, 376, 261 |

RECAPITULATION

| | |
|--|------------------|
| Total funds available to Bureau of Mines----- | \$52, 560, 428 |
| Obligations incurred----- | 35, 376, 261 |
| Unobligated balance of funds----- | 17, 184, 167 |
| Anthracite mine drainage----- | 8, 171, 355 |
| Construction 14X0954----- | 1, 243, 835 |
| Construction for Army----- | 1, 896, 770 |
| Helium balance----- | 4, 303, 296 |
| Balance available in fiscal year 1958----- | 730, 235 |
| Balance under fiscal year funds not available----- | 838, 676 |
| Total----- | 17, 184, 167 |

Personnel

Manual.—Ten chapters of the Personnel portion of the Administrative Series of the Bureau of Mines Manual were issued covering policies and procedural instructions in these fields: Staffing, employee development, appeals, compensation for injury, social security, retirement, program evaluation, and employee health and safety.

Development of Employees.—The Bureau continued to participate in the departmental management training program. Secretaries, stenographers, and typists received training on preparing correspondence, manuscripts, and other communication mediums. A bureauwide training and promotion agreement for student trainees was written and was approved by the Civil Service Commission. It provides a uniform bureauwide plan for on-the-job training for student employees in engineering and science.

First-aid training on a voluntary basis was provided Washington office employees.

Staffing.—The Branch assisted in preparing a Bureau of Mines recruiting brochure. A statement containing general information on employment was printed for distribution among applicants. The

Bureau's promotion and in-service placement program went into effect in February.

The Personnel Branch participated in a program to give Explorer Boy Scouts information concerning engineering and scientific career opportunities.

A new examination for commodity industry analyst (minerals), grades GS-5 through GS-12, was prepared and was announced April 2, by the Bureau of Mines Board of United States Civil Service Examiners.

Safety.—The Bureau was awarded the Department's Green Cross emblem for the greatest improvement in employee safety for October, November, and December 1956 and January and February 1957. Although final figures were not available the Bureau estimated that its disabling-injury frequency rate for fiscal year 1957 probably will be lower than in 1956. A Bureau group was named to recommend policy and procedures for protection against radiation.

Employee Relations.—The Personnel Office cooperated with various committees, Bureau, departmental, and governmentwide, in coordinating and improving the Government's employee-relations programs. The revised Bureau of Mines Employees Handbook was given all employees during the year. A program was established to give emblems to employees with 10, 20, and 30 years of Government service.

Classification.—Reviews, field surveys, conferences, and discussions were held with employees to assure compliance with job-classification requirements. New standards for coal-mine inspector positions were prepared and were submitted to the Civil Service Commission. Surveys were conducted throughout the Bureau's largest health and safety district, and five field stations were visited.

Performance Ratings.—The Whitten amendment review of positions was combined on a trial basis with the performance-rating employee interview requirements of the Department's performance-rating plan. If it proves efficient and practical, the procedure will become bureauwide.

Interbureau Conference.—The branch participated in arranging and conducting the Interbureau Conferences on Career Service in the Department of the Interior in Portland, Oreg., Denver, Colo., and Washington, D. C.

Schedule and number of paid employees

| | GS | Ungraded | Total |
|-------------------|--------|----------|--------|
| Departmental..... | 612 | | 612 |
| Field..... | 2, 931 | 1, 061 | 3, 992 |
| Total..... | 3, 543 | 1, 061 | 4, 604 |

Incentive Awards.—Activity in the incentive awards program almost doubled during fiscal year 1957. Following is a summary:

| | |
|---|----------|
| Suggestions received during the year----- | 971 |
| Suggestions receiving awards----- | 320 |
| Total of cash awards granted----- | \$8,520 |
| Suggestions resulting in estimated annual savings----- | 58 |
| Suggestions resulting in intangible savings----- | 262 |
| Total estimated annual savings----- | \$63,484 |
| Awards based on superior performance----- | 57 |
| Total cash awards granted for superior performance----- | \$16,464 |
| Special acts or service awards----- | 3 |
| Total of cash awards granted for special acts or service----- | \$1,300 |
| Total honorary awards granted----- | 38 |

OFFICE OF OIL AND GAS

Hugh A. Stewart, *Director*



IN LESS THAN 10 years, there have been two major petroleum crises. The first emergency occurred during the spring of 1951 upon the shutdown of one of the world's largest refineries at Abadan in Iran. The second crisis involved the closing of the Suez Canal and the disruption of certain Middle East pipelines, which occurred during this fiscal year.

In the recent crisis, the Office of Oil and Gas exercised leadership in the formulation and effectuation of measures to protect the security and defense interests and programs of the United States as hereinafter described.

THE MIDDLE EAST PETROLEUM EMERGENCY

On July 26, 1956, the Government of Egypt nationalized the Suez Canal through which approximately 1,478,000 barrels of petroleum were transported every day for use of friendly foreign nations in the Eastern Hemisphere west of Suez. In the circumstances, it became necessary promptly to consider the possibility of a serious interruption in the flow of petroleum through the canal and the pipelines in the Middle East. Because of the effect which such an interruption would have upon the Western Free World, including those nations allied with the United States in the NATO, on August 1, 1956, the Secretary of the Interior, at the suggestion of the Director of the Office of Defense Mobilization, declared that an emergency existed which required the preparation of a plan of action under the Voluntary Agreement Relating to Foreign Petroleum Supply, as amended May 8, 1956. The plan was to be one for the prevention, elimination, or alleviation of shortages in petroleum supplies which would threaten to affect adversely the defense mobilization interests or programs of the United States.

Developments in the Middle East situation culminated in the closure of the Suez Canal, on October 31, 1956, and the disruption in Syria, on November 3, 1956, of the petroleum pipeline from Iraq carrying some 544,000 barrels of oil per day. Thus, the Middle East petroleum transport stoppage, which threatened in late July and materialized at the beginning of November, involved over 2 million barrels of petroleum per day, or nearly two-thirds of the normal requirements, approximately 3,250,000 barrels per day, of the West of Suez areas affected.

Following the Secretary's action on August 1, the chairman of the Foreign Petroleum Supply Committee immediately initiated the necessary action for preparation of a "plan." Pursuant to call of the chairman, the Foreign Petroleum Supply Committee met on August 7, 1956, and prepared a "plan" which it submitted on the same day to the Secretary of the Interior. After review and modification, the "plan" was submitted by the Acting Secretary of the Interior to the Director of the Office of Defense Mobilization for his approval, and for the approval by the Attorney General of the request to designated American oil companies engaged in foreign operations to participate in it.

After several conferences, involving the Office of Defense Mobilization, Department of Justice, and Department of the Interior, at which additional revisions were made, the plan of action to deal with the Middle East petroleum emergency was promulgated on August 10, 1956. Sixteen oil companies became participants and members of the Middle East Emergency Committee established by the plan. One other oil company, a subsidiary of one of the participants, became a participant but not a member of the Committee.

Plan of Action

The fundamental objectives of the plan of action were the formulation and effectuation of measures to offset or minimize petroleum shortages and dislocations in friendly foreign areas which might be brought about by a Middle East petroleum transport stoppage. To attain these objectives, the plan provided for the establishment of the Middle East Emergency Committee composed of American oil companies having, in the aggregate, petroleum operations extending throughout the Free World. It also provided for the establishment of subcommittees to assist the Middle East Emergency Committee in its assignments.

Seven such subcommittees were appointed by the Administrator as follows: Supply and Distribution Subcommittee, Tanker Transportation Subcommittee, Production Subcommittee, Refining Subcommit-

tee, Pipeline Transportation Subcommittee, Statistical Subcommittee and Information Subcommittee.

Substantially, the plan of action authorized the Middle East Emergency Committee and its subcommittees to engage in only two types of activities: (1) at the request of the Administrator or the Director (an official of the Office of Oil and Gas appointed by the Administrator), to prepare and furnish to the Government information and data essential to the development of measures to offset shortages resulting from a Middle East petroleum transport stoppage, and (2) to prepare schedules of actions to be taken by the participants and others to meet such shortages.

Activities of the Middle East Emergency Committee

The activities of the Middle East Emergency Committee and its subcommittees fell into three phases. The first phase extended from August 24, 1956, the date of the first meeting, to December 3, 1956. The second phase covered the period from December 3, 1956, when the Middle East Emergency Committee was requested by Government to begin the preparation of schedules and the taking of actions to alleviate petroleum shortages resulting from the stoppage of the Suez Canal and the Iraq Petroleum Co. pipeline, to April 18, 1957. The third phase extended from April 18, 1957, the date as of which the Administrator suspended all existing schedules, to June 30, 1957, the end of all active operations.

During the first phase, August 24, 1956 to December 3, 1956, the Middle East Emergency Committee and its subcommittees were engaged exclusively in the preparation of information and data concerning foreign petroleum operations as requested by the Administrator or the Director. Such preparation comprised the gathering, analyzing, and evaluating of pertinent information and data covering the whole range of foreign petroleum activities, including production, refining, transportation, particularly tanker and pipeline transportation, supply and distribution, stocks and inventories.

In the first phase, the Middle East Emergency Committee and its subcommittees met on an average of three or four times a week. Some 146 technical experts from the member companies served on the various committees. The meetings were supervised by representatives from the Office of Oil and Gas, two of whom were assigned on a full-time basis, and were attended by many representatives of other governmental agencies, particularly the Office of Defense Mobilization, Department of State, Department of Defense, and Department of Justice, as well as by high officials of the Department of the Interior.

The second phase, extending from early December 1956 to around the middle of April 1957, covered the critical period of the Middle East petroleum crisis. The most important problems arose and were solved during this period. Practically all the actions devised by the Committee, and reflected in schedules, to offset the supply shortages in the Eastern Hemisphere west of Suez were taken during the second phase which began on December 3, 1956. Effective December 3, 1956, the plan of action was amended to provide greater flexibility and efficiency in the operations of the Committee and the participants under the plan. Five schedules of action and three amending schedules were prepared by the Committee and recommended to the Secretary of the Interior as Administrator of the agreement during this phase. Four schedules and two amending schedules were approved and issued by the Administrator. These schedules and amendments originally had a termination date of March 31, 1957. Some were extended to May 31, 1957. In addition to preparing schedules, the Committee continued throughout the second phase, to gather, evaluate and keep current pertinent information on all aspects of foreign petroleum operations.

Both the Government and the Middle East Emergency Committee kept the schedules and the actions taken pursuant thereto under continuous review. For this purpose, the Administrator established the Plan of Action Review Committee comprised of representatives from the Office of Defense Mobilization and the Departments of State, Defense, Justice, and Interior. The Supply and Distribution Subcommittee made a semimonthly analysis of actions taken under schedules and offered suggestions as to the more effective implementation thereof.

During the second phase, the Middle East Emergency Committee and its subcommittees held 40 meetings, consisting of 54 daily sessions, an average of approximately three meetings a week over the entire period. Some 178 technical experts from the member companies served on the various committees. The same Government supervision and attendance took place as in the first phase.

The third phase began when the Administrator suspended all schedules on April 18, 1957. It extended through June 30, 1957, after which no active operations were contemplated. During this phase, the activities of the Committee and its subcommittees were confined to the preparation of data and reports to keep the Administrator informed as to the status of supply positions in the affected foreign areas and to the completion of the historical record of petroleum movements from the time of the stoppage in early November until the resulting shortages were substantially overcome in the second quarter of 1957. Supervision by Office of Oil and Gas representatives con-

tinued without let-up during this phase, but attendance by other agencies diminished.

Cooperation with Foreign Agencies and Committees

It was recognized by the Government, based on experience during the Iranian petroleum crisis of 1951-1952, that, in the event of stoppage of the Suez Canal and any of the Middle East pipelines, there would have to be cooperation and coordination between the Middle East Emergency Committee, its subcommittees and the participants in the plan of action, on the one hand, and foreign industry committees, and possibly governmental agencies, particularly in Europe, on the other. Such relationship was specifically authorized by the plan of action, and urgently recommended by the Department of State. Accordingly, the Administrator designated, in succession, the following foreign groups with which the Middle East Emergency Committee, its subcommittees and the participants should cooperate and coordinate their activities: the British Oil Supply Advisory Committee, made up of representatives of British and Dutch oil companies, the Oil Emergency London Advisory Committee, made up of representatives of British, Dutch and French oil companies, and finally, the Organization for European Economic Cooperation and its Oil Committee, made up of representatives of 17 European governments, as well as a foreign industry advisory committee, known as the Organization for European Economic Cooperation Petroleum Emergency Group, which was set up by OEEC.

These foreign groups were concerned with the Middle East petroleum crisis from the European viewpoint. Their representatives participated in all the meetings of the Middle East Emergency Committee and its subcommittees and furnished information and data in the same manner as did the members of these committees. Similarly, representatives abroad of some of the members of the Middle East Emergency Committee attended meetings of the foreign industry committees and furnished pertinent information and data to them. The American companies were required to render a full account of such coordination and cooperation in periodic reports which were transmitted by the Administrator to the Attorney General. Such participation did not include allocation of supplies among the various European countries. This was handled by the foreign governments through the Organization for European Economic Cooperation Oil Committee. The cooperation between the Middle East Emergency Committee and their foreign counterparts proved very effective and was one of the principal reasons for the successful solution of the Middle East petroleum emergency.

Termination of Plan of Action

In the light of the satisfactory supply position in the second quarter 1957 as estimated by the Middle East Emergency Committee, and in view of the reopening of the Suez Canal to tanker movements, the Secretary of the Interior, in his capacity as Administrator of the agreement, on June 29, 1957, determined that the activities of the Middle East Emergency Committee should be suspended, and that, in the absence of any material change in the situation, the plan of action should be terminated and the Committee disbanded as of July 31, 1957.

Results and Accomplishments of Program

The outstanding success of the program is shown by the following facts: During the period, of the actual emergency, generally from November 1, 1956, through March 31, 1957, an average of 3,007,000 barrels per day of petroleum, or 90 percent of the normally required supplies of 3,250,000 barrels per day (which included not only daily consumption demand but normal seasonal inventory buildup), were made available to the affected areas. As a result, there was no disruption, at any time, in the economic life of any of the affected areas because of lack of petroleum supplies. Thus, the sole objective of the program, namely, to prevent a substantial petroleum supply shortage in friendly foreign areas, was attained.

In the success of the program, the Middle East Emergency Committee and its members, aided immeasurably by representatives of the foreign committees, played the major role. Others who contributed vitally to the successful outcome were the State regulatory agencies, Caribbean governments and the many oil companies, which made the large quantities of essential supplies available from the Western Hemisphere, and United States Government agencies, particularly the Coast Guard and the Military Sea Transport Service, which were responsible for making additional tanker capacity available.

TANKER FLEET STATUS AND OUTLOOK

Nationalization of the Suez Canal and subsequent events made it desirable for Government in its emergency planning to focus attention and study on the status and outlook of the worldwide tanker fleet. Faced with the possibility of a shortage of tankers in the petroleum trade, it appeared necessary that a review be made of the present and future status of the tanker fleet. Government agencies with responsibilities in connection with tanker transportation reviewed and summarized information available in Government.

President Dwight D. Eisenhower by memorandum, dated October 12, 1956, to the Director of the Office of Defense Mobilization directed him to take steps immediately to bring together representatives of the National Petroleum Council to meet with the Secretaries of State, Treasury, Defense, Commerce, and Interior to consider plans to assure the efficiency and adequacy of the distribution of petroleum supplies in the foreseeable future in the Free World.

It was stated that the plans should, so far as the interests of the United States are thereby served, provide for the building in United States shipyards of a sufficient number of large tankers to help supplement existing means of distribution and, if necessary, to help serve as an alternative in the transportation of oil in the Free World, particularly from the Middle East.

The Director of the Office of Defense Mobilization immediately got in touch with the Director of the Office of Oil and Gas in the Department of the Interior to formulate plans to comply with this memorandum. On October 15, 1956, the Secretary of the Interior asked the chairman of the National Petroleum Council to arrange for the group to meet in Washington.

The chairman of the National Petroleum Council and 15 members of the Council met with Government officials on October 19, 1956. The group discussed the tanker capability of the Free World's shipyards, particularly for large tankers—60,000 tons and over, and pertinent matters related thereto. Inasmuch as the Government was interested in getting industry's views as to the size of the tankers that the industry was planning in its construction schedules and whether private industry would buy tankers of an agreed-upon size for a period of 24 months if such a program were set up, the Director of Defense Mobilization, who presided as chairman of the meeting, called another meeting for October 25, 1956. This was done to afford the industrialists an opportunity to further study the matter and to enable them to give estimates as to what their companies might do.

On October 25, 1956, the second meeting was held. It was suggested that the National Petroleum Council make a tanker study and supply whatever factual information was needed by Government. This suggestion was offered in view of the fact that apparently a large number of tankers were planned for construction by industry and it did not appear that the individuals from industry present at these meetings were in a position to state future company plans on tanker construction. With that decision made, the Director of Defense Mobilization referred the matter to the Department of the Interior for further action.

Then, on October 29, 1956, the Assistant Secretary of the Interior in charge of mineral resources made a request upon the National Petroleum Council. The request called for a study of petroleum tanker

transportation that includes the United States and worldwide construction schedules, by number and size, between now and 1965, without regard to registry.

The National Petroleum Council undertook the study at once, making an interim report on December 14, 1956. This interim report contains data such as a statement showing the number and tonnage of tankers reported under construction or on order as of November 1, 1956, information on the salient characteristics of typical tankers of various sizes, and data on drydocks capable of taking ships of 102' beam.

A final report, World Petroleum Tanker Construction, was submitted to the Secretary of the Interior on March 7, 1957. That tanker report of detailed information on the worldwide tanker construction programs includes data on tankers under construction, on order, or definitely planned.

The World Petroleum Tanker Construction Report indicates that the worldwide tanker fleet will be greatly expanded in the next 10 years, with a significant increase in the number of large tankers. Previously, Government had no accurate long-range information of this nature.

This report is being used in Government in further studies of worldwide petroleum transportation problems, particularly as related to movements from the Middle East.

WARTIME PLANNING AND THE MILITARY PETROLEUM ADVISORY BOARD

Most of the defense planning with respect to oil and gas within the past 3 years has been based on a wartime petroleum and gas supply-demand study which was started in September 1954 and completed the following March.

This was the first such study which included damage factors of enemy attack with thermonuclear weapons within the continental United States. This study was carried on by the Office of Oil and Gas in cooperation with the oil and gas industries, through the Military Petroleum Advisory Board, a group of foremost technical experts in the oil and gas industries. Strategic assumptions and guidance were provided by the Department of Defense. The report on this study has been of great value to the Department of Defense, the Department of the Interior, and to the Office of Defense Mobilization, but it is now out of date.

Last spring the Department of Defense notified the Office of Oil and Gas that it was preparing the strategic assumptions and guidance

for a new war study for which a new worldwide petroleum and gas supply-demand study would be required. As a result, by joint request of representatives of the Departments of Interior and Defense, the Military Petroleum Advisory Board has under way the new study which will provide the up-to-date petroleum and gas information and interpretation as necessary, to the Departments of Interior, Defense, and the Office of Defense Mobilization in their national security and defense planning.

PEACETIME STUDIES AND THE NATIONAL PETROLEUM COUNCIL

Government continued to rely on the National Petroleum Council for help and cooperation in providing basic petroleum information and advice on requests made upon it.

At the request of the Office of Oil and Gas, the Council completed several important studies, in addition to the one already mentioned, covering the underground petroleum storage situation in this country, and manpower in the oil and gas industries, and made reports thereon for use of Government.

The Council is now engaged in studies to furnish data and reports covering domestic petroleum transportation, refinery capacity, availability of liquefied petroleum gas, petroleum storage capacity, and petroleum productive capacity. Information on these will be valuable to Government in its consideration of the short-term and long-range petroleum situation, and are basic to a re-evaluation of our oil and gas capabilities in event of war.

STAFF ADVICE AND ASSISTANCE

The small staff of executive and technical experts gave advice and assistance to the Secretary of the Interior and to the personnel of other Government agencies on a wide range of petroleum and gas matters affecting the utilization of the petroleum and gas resources in the Nation's expanding economy. Over 40 Government agencies have an interest in petroleum and gas matters.

RELATIONSHIP WITH CONGRESS

The Office of Oil and Gas rendered service to Congress in supplying information on every query brought to its attention by Members of Congress and their professional and secretarial assistants. Officials of the Office also presented information and were witnesses at congressional committees in the conduct of petroleum and gas investigations.

SERVICE TO THE PUBLIC

In its daily operations, citizens from all walks of life have called upon the Office of Oil and Gas for information or guidance on individual problems. Public understanding of Federal oil and gas administration and activities has been furthered in addresses and statements issued from time to time by the Secretary of the Interior, the Assistant Secretary-Mineral Resources, and the Office of Oil and Gas officials.

FOREIGN RELATIONS OF OFFICE OF OIL AND GAS

The Office of Oil and Gas was active in North Atlantic Treaty Organization activities. It is essential that the NATO planning be realistic and sound as well as coordinated properly with the wartime planning of this country and, for that reason, the Office sent a petroleum adviser to meetings of the NATO Petroleum Planning Committee and provides the chairman for its Working Group.

Several meetings were held in Paris, France. Either the Director or the Assistant Director in charge of programing of the Office of Oil and Gas, or both, participated in these sessions.

At the request of the Department of State, an Office of Oil and Gas specialist on gas was the United States delegate to the Nato Public Utilities Working Party when it met, in September 1956, in Paris, France, to review the civilian defense aspects of gas supply, which is principally manufactured gas, for European cities.

Also, in the foreign field, the Office of Oil and Gas worked closely with the Organization for European Economic Cooperation. Its Petroleum Committee concentrates on the contribution petroleum can make in the development of Europe's economy. While the United States is not a member of this organization, Government officials work closely with it in supplying technical advice.

FEDERAL CIVIL DEFENSE ACTIVITIES

Federal Civil Defense Administration Delegation No. 3, dated August 13, 1955, delegated authority to the Secretary of the Interior to plan and direct Federal activities designed to procure, store, transport, and distribute adequate fuel supplies in a civil defense emergency. Responsibilities for taking action to organize and plan for solution of petroleum and gas supply problems under emergency conditions was assigned to the Office of Oil and Gas.

General principles for handling of petroleum and gas during an emergency were formulated by the Office of Oil and Gas after it had made a preliminary survey as to what plans FCDA and the States were making to cope with petroleum and gas supply problems. For

the first time, guidelines, including organizational and operational charts, have been made available and distributed for use by civil defense officials in local, State, and regional organizations and to Federal agencies whose planning would be affected by the Federal Government's petroleum and gas plans.

The main principle to be followed is that the Federal Government will exercise overall control of primary petroleum supply in periods of extreme emergency. Secondary oil supply will be controlled at the local level by civil defense or rationing authorities.

Operation Alert 1956 was held during July, and the staff of the Office of Oil and Gas participated in this exercise.

INDUSTRIAL EXPANSION GOALS AND ACCELERATED TAX AMORTIZATION

The Office of Oil and Gas was responsible for departmental activities regarding the industrial expansion of the oil and gas industries needed to build up the mobilization base. Accelerated tax amortization was available for facilities qualifying under established criteria. Policy guidance for the program was given by the Office of Defense Mobilization.

The Office of Oil and Gas continued its function of analyzing the applications for rapid tax amortization and submitting reports to the Office of Defense Mobilization.

ODM closed certain goals following studies which indicated that sufficient capacity is planned or exists to meet known mobilization requirements. The goal covering construction of alkylation facilities was closed on December 28, 1956, one for oil and gas pipelines for specific defense programs was closed on April 25, 1957.

Following the closing of those goals, only two expansion goals established by ODM which might be applicable to certain types of petroleum and gas facilities, as well as those of other industries, remained open. These were Goal No. 224 (Production Facilities for Military and Atomic Energy Procurement) and Goal No. 206 (Laboratories, Research and Development). Under Goal No. 224, oil and gas pipelines used solely to supply military installations or Atomic Energy Commission projects and petroleum storage facilities erected solely for military use could be considered for accelerated tax amortization.

Reports and recommendations were made to ODM covering 245 applications for accelerated tax amortization and post certification actions during this fiscal year. The Office of Oil and Gas submitted 43 recommendations for approval of certificates of necessity for accelerated tax amortization, and 59 for denial of certificates; 96 scope

amendment requests were recommended for approval, and 6 for denial; 39 recommendations for approval of time extensions, and 2 for denial.

COOPERATION FROM STATES

The Director of the Office of Oil and Gas represented the Department of the Interior at the Interstate Oil Compact Commission meetings. Cooperation from the State oil and gas regulatory agencies was received in daily contacts of the Federal Petroleum Board in administering the Connally Act.

CONNALLY ACT ADMINISTRATION

Mandatory authority of the Office of Oil and Gas was limited to administration of the Connally Act which supports the conservation activities of the oil producing States. The act, which became effective February 22, 1935, prohibits interstate shipment of oil produced in violation of certain State oil and gas conservation laws and orders issued thereunder.

Administration of the Connally Act is carried on by the Federal Petroleum Board under direction of the Secretary of the Interior and supervision of the Office of Oil and Gas. The Federal Petroleum Board consisted of a chairman and a member during the fiscal year, as the alternate member post was vacant. The Board was headquartered in Kilgore, Tex., and maintained field offices at Midland and Victoria, Tex., and Lafayette, La.

While the Connally Act is applicable wherever State laws limit the rate of production and prescribe conditions for producing and handling of oil, its chief application is in the States of Texas, Louisiana, and New Mexico, whose regulations prescribed under the act are enforced by the Board. So far as possible with the limited resources at its command, the Board also enforces the provisions of the act in other oil-producing States, particularly in Mississippi, Oklahoma, Arkansas, and Kansas.

Unless special exemptions are made by the Board in writing and by notice, all operators producing oil within the designated area are required to maintain daily production records and file monthly production reports of operations on each lease in the oilfield as prescribed in the form applicable to the producer; also transporters and refiners are required to file monthly reports on prescribed forms with the Board at Kilgore, Tex. The designated area consists of 106 counties in the State of Texas, the counties of Lea and Eddy in the State of New Mexico, and the entire State of Louisiana.

From the designated areas the Board regularly received and processed each month approximately 9,007 monthly producer's reports,

about 501 monthly pipeline reports, and 71 reports from processors and refiners. These reports covered operations in 3,422 separate oil fields and accounted for approximately 63.01 percent of the entire production in the States of Texas, Louisiana, and New Mexico, which was approximately 4,237,281 barrels daily.

During this fiscal year reports covering oilfield operations increased from 2,998 to 3,422 oilfields, an increase of 424 fields. The reports on producing wells increased from 81,878 to 88,371, an increase of 6,493 wells added to the inspection area in one year.

In this fiscal year, 2,199 leases were inspected, 2,698 leases were visited, and 15 pipelines were checked. To accomplish this, 425 oilfields were visited, and 957 investigations were conducted.

There were 9 cases of alleged violation of the Connally Act on the docket of the Federal Petroleum Board when the fiscal year began. Twelve new investigations were started during the fiscal year.

Six cases were closed by court action during the fiscal year, and fines paid amounted to \$52,100.

On June 30, 1957, of the 15 cases on the docket, 7 cases were pending disposition by the United States attorneys, 3 were under review by the Solicitor's office, and 5 were under investigation by the Board.

DEFENSE MINERALS EXPLORATION ADMINISTRATION

C. O. Mittendorf, *Administrator*



THE PROGRAM to encourage exploration for deposits of strategic and critical minerals in the United States, its territories and possessions conducted by the Defense Minerals Exploration Administration pursuant to a delegation of authority from the Office of Defense Mobilization to the Secretary of the Interior was continued during the fiscal year 1957.

Under this program assistance to private industry is provided by the Government through the DMEA participating in the costs of exploring for critical and strategic minerals to the extent of 50 or 75 percent, depending upon the mineral or minerals sought. Funds for the Government's share of the exploration costs are allocated from the borrowing authority under the Defense Production Act of 1950, as amended. Based upon sound engineering and geological principles, exploration projects are established by contracts between the Government and mine operators. These contracts call for specific work to be performed within specified costs on definite areas or parcels of land and to be completed during a fixed period of time. If, in the opinion of the Government, the exploration work has been successful in finding ore, a Certification of Discovery or Development is issued, and the contribution to the cost of the work by the Government is repayable on a royalty percentage basis of $1\frac{1}{2}$ to not more than 5 percent of the sales receipts for any ore produced from the date of the contract until a specified time, usually 10 years, has elapsed from that date, or the amount of the Government's contribution has been repaid in full, whichever occurs first.

The DMEA administers the program with a small Washington staff, five field auditors, and the cooperation of the Federal Bureau of Mines and the Geological Survey in providing technical field services. Private industry participation in the program, represented by indi-

viduals, partnerships, and corporate enterprises, is widespread. The program is especially appealing to small business as evidenced by the large number participating.

During the fiscal year 1957, 406 applications for Government aid were received, bringing the total number of applications received since the beginning of the program in mid-1951 to 3,585. This total includes requests for aid on projects located in 43 States and Alaska. The DMEA has executed 127 contracts in the 12-month period ending June 30, 1957. The total number of contracts executed since the inception of the program is now 1,038. These contracts represent exploration projects in 34 States and Alaska, and as a group, include 28 different metals and minerals. At the beginning of the fiscal year 1957, there were 198 contracts in force, but this figure dropped to 194 at the end of the fiscal year. From the start of the program to date, 66 contracts have been canceled without any work having been performed on them. Only 4 of these 66 contracts were canceled in the past fiscal year. Government commitments made under contracts during the past 12 months amounted to \$4,752,433, and now total \$30,931,435. The total estimated cost of the 127 contracts and amendments executed during fiscal year 1957, including industry participation, amounts to \$7,692,916, and for the 1,038 contracts executed and amendments since the beginning of the program is \$50,290,152.

In the past 12 months, 76 contracts under which actual work was performed were terminated without certification of discovery or development. The cost of these 76 projects was originally estimated at \$2,547,242, with Government participation set at \$1,484,667, but the actual cost to the Government was only \$873,236. At the end of the fiscal year, 503 contracts having a total project cost of \$13,576,697 had been terminated without certification. The Government's share in the cost of these contracts was estimated at \$8,504,995, of which only \$5,046,791 was expended. Although a few of these terminated projects have found small quantities of ore, the amounts were not sufficient to warrant their being certified. However, valuable geological information was obtained from all of these terminated projects.

Certifications of discovery or development issued by the DMEA in the past 12 months totaled 53. These certified projects had an aggregate cost of \$4,951,380. Although the Government was committed to participate to the extent of \$3,259,483 on these 53 projects, only \$2,905,819 of Government funds were actually expended. As of June 30, 1957, 299 projects having a total cost of \$18,082,842, have been certified by the DMEA. Participation by the Government in these 299 projects was set at \$11,394,778, but only \$9,113,481 has been

contributed by the Government to date, since work on some of the terminated projects was completed at less cost than anticipated and the work on others is still in progress. Repayments to the Government in the form of royalties at the end of the fiscal year 1957 totaled \$1,886,387 from 325 operators. One hundred and eighty-seven of these 325 operators paid \$538,684 during the past 12 months. Some 27 operators have paid in full the amount of the Government's participation in their projects totaling \$447,212.

The 299 certifications were on projects carrying out exploration for antimony, asbestos, beryl, chromium, cobalt, columbium, copper, corundum, fluorspar, iron, lead, manganese, mercury, mica, monazite, nickel, rare-earths, rutile, sulphur, talc, tantalum, thorium, tin, tungsten, uranium, and zinc. Fifty-four of the certified projects were in North Carolina, 42 in Colorado, 37 in Utah, 26 in Idaho, 18 in California, 17 in Nevada, 15 each in Arizona and Montana, 12 in Washington, 10 in Wisconsin, 8 in South Dakota, 7 in New Mexico, 6 in Alaska, 5 in Georgia, 3 each in Alabama, Illinois, Missouri, and Wyoming; 2 each in Arkansas, Virginia, and Vermont; and 1 each in Florida, Iowa, Maine, New Hampshire, New Jersey, Oregon, South Carolina, Tennessee, and Texas. Twenty-two of the 299 certified projects had not been completed as of June 30, 1957. At prices in effect at the end of the fiscal year a conservative estimate of the recoverable value of the ores and minerals found on the 299 certified projects is approximately \$444 million. Substantial ore-showings disclosed on 29 other projects may eventually lead to their certification.

Each application for an exploration project requires a study by technical experts. In most cases an on-site examination is made of the proposed project by personnel of the Geological Survey and the Bureau of Mines. Based upon a study of all available information, including the results of the field examination, the proposal is either denied or a project is approved and a contract executed. A total of 1,755 applications have been denied as of June 30, 1957, 282 of them in the past fiscal year. A total of 637 applications have been withdrawn, but only 74 in the past 12 months.

Applications were received during the past fiscal year at about the same rate as in the previous year but with some slackening off in the last few months. Uranium applications continue to be received in the largest number. The fewer applications for tungsten received in the last half of the year than in the first half evidently reflected the ending of the Government buying program for this material.

The Contract Administration and Audit Division of DMEA continued its auditing program at a steady rate. This Division had completed a total of 983 audits certifying Government disbursements

of \$15,033,464 on 832 projects, as of June 30, 1957. Of these 983 audits, 155 were made in this fiscal year and certified Government disbursements of \$2,657,888. Of the 155 audits made, 126 covered projects not previously audited. To date approximately 80 percent of the exploration program disbursements have been audited. In addition, 48 audits have been made for production purposes in the last 12 months. Of these 48 audits 29 covered projects not previously audited for royalty payments. The 48 audits covered sales of production totaling \$5,281,880, on which royalties payable to the Government amounted to \$262,378. As of June 30, 1957, 226 production audits on 175 projects have been made involving ore shipments of \$20,761,234, and royalties payable to the Government totaling \$1,001,771.

In January 1957, the DMEA instituted new filing procedures which reduced the volume of space by consolidating files and eliminating some material no longer needed. The pamphlet titled "The Defense Minerals Exploration Program," explaining the program in question and answer form, was revised so as to clarify certain questions and to bring it up to date with current procedures, and was made available in March 1957. In order to help the applicant in supplying information needed to process his application, the DMEA Form MF-103, "Application for Aid in an Exploration Project" was also revised in February 1957, and made available in April.

The fine cooperation of other Government agencies and extensive participation of mine operators have aided materially in making the program a success. Particularly significant is the large number of small operators participating in the program. Approximately 60 percent of all contracts call for expenditures of less than \$25,000, and 43 percent of all contracts provide for total expenditures of less than \$3,000 of the operator's own funds. Individuals and partnerships comprise about two-thirds of the operators. Substantial quantities of strategic and critical minerals have been found. Although current production is small, the ultimate production from successful projects will be important to the Nation's economy and defense. On some projects deposits have been found that are uneconomic to mine under current conditions and market prices, but which will be available if needed in times of emergency. The deposits found under the DMEA program constitute an important element of the Nation's mobilization base.

OFFICE OF MINERALS MOBILIZATION

Spencer S. Shannon, *Director*



THE OFFICE of Minerals Mobilization was established in January 1955 to carry out the Secretary's responsibilities for national defense preparedness in minerals, metals and solid fuels, under delegations from the Office of Defense Mobilization.

During the past year, the Office has carried forward a program designed (a) to assure an adequate supply of the 85 minerals, metals and solid fuels under its jurisdiction to meet essential civilian and military requirements in the event of national emergency; (b) to provide continuity of government under defense emergency and attack conditions; and (c) to provide continuity of industrial production of metals, minerals and solid fuels under defense emergency and attack conditions.

Working in close collaboration with the Bureau of Mines and Geological Survey, the Office completed during the year 20 comprehensive mobilization base evaluations, 3 expansion goal studies and 7 other special studies, and forwarded to ODM recommendations, based on these reports, for action deemed necessary to achieve and to maintain an adequate national defense supply position. As of June 30, 1957, 16 comprehensive evaluations and reviews were in progress.

In preparation were summaries designed to maintain current information on the mobilization status of all assigned strategic metals and minerals for internal operational and policy reference.

In the case of solid fuels, the Office continued to carry out its responsibility for evaluating and recommending on applications by industry for certificates of necessity for accelerated tax amortization under the Internal Revenue Code and for loans under the Defense Production Act. Through June 1957 a total of 176 necessity certificates had been certified and 28 canceled with 148 still outstanding at

a total value of \$703,554,000. Of these 84 were for coke, 59 for metallurgical coal, 2 for coal in Alaska and 3 miscellaneous.

The Office continued working closely with other Government agencies having responsibilities for mobilization planning. Special attention was given to advising and assisting in connection with the Department of Agriculture's program on barter of agricultural surplus commodities for strategic metals and minerals.

In carrying out its responsibilities for assuring continuity of government in the event of a national emergency, the Office made progress in establishing operational facilities at the Relocation Center. Essential documents and files were assembled at the Center and procedures were established for maintaining them on a current basis.

Activities with respect to plans and readiness were continued toward the objective of preparedness for emergency operations of the minerals and solid fuels industry. To this end recruiting of executive reservists continued. During the year this Office appointed the first 15 of possibly 118 executive reservists who will serve in the minerals and solid fuels areas. Eleven others have expressed a willingness to serve in the event of an emergency.

Work was continued in developing standby control orders covering allocation of metals and minerals to be put into effect in the event of emergency, and in providing for adequate supplies of controlled materials to the producers of metals, minerals and solid fuels.

During the year data were collected on domestic production facilities for inclusion in the Office of Defense Mobilization's damage assessment program. An initial compilation was completed for 40 metal and mineral commodities which represent most of the facilities under the jurisdiction of the Office.

The Office continued to prepare data for and cooperate with the Industry Evaluation Board in the evaluation of industrial plants that fall within the purview of the Office.

OFFICE OF GEOGRAPHY

Meredith F. Burrill, *Director*



THE OFFICE OF GEOGRAPHY was established to carry out the responsibilities of the Secretary of the Interior under the act of July 25, 1947, conjointly with the Board of Geographic Names. The Office performs the research and other staff functions relating to the standardization of geographic names for use by the Federal Government.

The work of the Office in 1957 was chiefly concerned with names in areas outside the continental United States. Substantial files of standardized names were compiled for more than 20 foreign areas, increasing the size of such files to nearly 2 million names, including variant spellings, and extending their coverage to all areas of the world outside the continental United States. More than 450,000 names were edited on maps and in textual materials for correctness of spelling and accuracy of application, and nearly 10,000 mail and telephone inquiries were answered. Over 200,000 names were prepared for publication in eighteen gazetteers for public sale.

Nomenclature policies were reviewed and modified or augmented for several countries, and new source materials were brought into use for many areas.

BOARD ON GEOGRAPHIC NAMES

The Board on Geographic Names is an interdepartmental organization established by the act of July 25, 1947, for the purpose of standardizing geographic nomenclature for use by the Federal Government. Its members represent the Departments of State, Army, Navy, Post Office, Interior, Agriculture, Commerce, and Air Force, and the Government Printing Office, the Library of Congress, and the Central

Intelligence Agency. Dr. H. Thompson Straw, Department of the Air Force, was chairman during the fiscal year 1957.

The Board and its committees met frequently to act on nomenclature policies, to approve names and to perform related functions. New policies were formulated and previous ones revised and extended.

In April 1957, Mr. P. J. M. Geelan, Secretary of the Permanent Committee on Geographical Names for British Official Use, and Mr. G. M. Munroe, Secretary of the Canadian Board on Geographical Names, visited the Board for conferences on policies to be used jointly in the standardization of foreign geographic names. Also the Board was asked by the United Nations Economic and Social Council to draft a statement of principles to be used in the international standardization of geographic names.


A new Hawaiian Names Advisory Committee was appointed, and the Advisory Committee on Antarctic Names, the Alaskan Names Advisory Committee, and the Advisory Committee on Arabic and Persian continued active.

The Board's series of gazetteers of foreign areas was increased to 40 by the addition of coverage of numerous oceanic island areas and several countries including Australia, Iraq, Italy, and eight Latin American countries. The entire series now available for public sale contains over 690,000 entries. A revised statement of the Board's Transliteration System for Arabic Geographic Names (the BGN/PCGN System) was also published.

Office of the Assistant Secretary

Public Land Management

Roger Ernst, *Assistant Secretary*



THE ASSISTANT SECRETARY for Public Land Management is responsible for directing and supervising the Bureau of Land Management, the Bureau of Indian Affairs, the National Park Service, and the Office of Territories. The Fish and Wildlife Service, formerly under his direction, received separate status in fiscal 1957 and now operates under its own Assistant Secretary for Fish and Wildlife.

During the past year each of the four bureaus scored impressive advances in the continuing drive to serve the public.

As economies expand in the public land States, new patterns of growth are shaped and the pattern of land usage changes. The Bureau of Land Management activities are influenced by growing demands on the lands and their resources. To meet those demands, the Bureau is using all available means to improve its operations.

Final regulations under the Multiple Use Act were issued last year. The law empowers the Government to manage surface resources on unpatented mining claims subject to the act. It also removed certain minerals from the mining laws and placed them under the Materials Act. Indications are that industry and the Nation as a whole will be benefited by opening vast timber resources.

Centralized, unified control of appeals actions has substantially reduced the backlog of lands and mineral cases on appeal to the Director. The Appeals Office's prompt and efficient dealing with cases has improved services to the public and smoothed the Bureau's operations. Appeals work has been separated from staff operations. Established in April 1955, the Office last fiscal year won a unit citation for meritorious service for its first 2 years of operations. The citation acknowledged the Appeals Office's enviable record and superior ac-

accomplishments in volume of cases processed and for the quality of its decisions.

The task of improving the public land records continued last year. Three major projects included reconstruction of the Utah and New Mexico land records and purchase of auxiliary equipment for the new records system.

During fiscal year 1957 the Bureau of Indian Affairs continued to stress educational and economical programs. Emphasis was maintained on the educational needs of Indian children, and enrollment of the youngsters hit a record total. Meanwhile, new efforts were made in the field of adult education. The special literacy training program for adults, begun in fiscal 1956, was expanded last year. Plans were completed for starting an adult vocational training program this year.

One of the more important economical developments of the year was the establishment of eight new industrial plants in the vicinity of Indian reservations.

Income from mineral leasing rose to new highs in the past year. Oil leases provided the greatest sums. But timber sales also soared to a record.

Two tribal groups reached the point last year where they were able to move out from under Federal trusteeship. Another group had left Federal trusteeship a year earlier. Three more groups are working toward terminal dates already set up, and three additional tribes are covered by readjustment laws enacted during the year with the tribes' concurrence.

The Mission 66 program of the National Park Service and the National Park System completed its first year in fiscal 1957. Mission 66 is a 10-year program of conservation, development, and improvement aimed at providing facilities for 80 million visitors by 1966, when the Service will celebrate its golden anniversary.

The Virgin Islands National Park was added to the System last year. Congress authorized the establishment of Horseshoe Bend and Pea Ridge National Military Parks. Officially established in the first year of Mission 66 were the Cape Hatteras National Seashore Recreation Area, Independence National Historical Park, Edison Laboratory National Monument, Fort Union National Monument, Booker T. Washington National Monument, Harpers Ferry National Monument, Chimney Rock National Historic Site and Golden Spike National Historic Site.

The Colonial Parkway and new visitor centers at Jamestown and Yorktown were completed in time to be used by the thousands of persons who visited the Jamestown-Williamsburg-Yorktown celebration.

The year also saw publication of the popular version of the official report on "Our Vanishing Shoreline." It made many readers aware

of the loss which threatens unless quick action is taken to preserve some of the shoreline which has so far remained unspoiled.

Additional concession facilities were provided in a number of areas. Prominent among them are the new Canyon Village in Yellowstone National Park and the Colter Bay development in Grand Teton National Park.

One of the most cheerful aspects of the year for the Office of Territories was the substantial progress which Alaska made toward achieving statehood. There is a possibility that in fiscal 1958 Alaska may become a State. Hawaii also showed progress in its campaign for statehood. The Administration is firmly determined that both shall be admitted to the Union as full partners instead of Territories.

In Alaska, for the first time, an Alaska-born citizen was named Governor. A similar first was scored in American Samoa when a native-born Samoan was named Governor.

Self-government in Alaska and Hawaii has advanced to the point where the Department need provide few political services.

The Office of Territories discontinued two of its functions in Alaska in fiscal 1957. The Department of Commerce took over the road-building and maintenance functions of the Alaska Road Commission, and Alaska's mental health program was transferred to the Territorial Government. The Alaska Railroad operated without congressional appropriations and increased its commercial services.

The Virgin Islands Corporation had one of its most successful years. It was unnecessary, for the first time in years in the Islands, to borrow money to finance current operations. American Samoa's fiscal affairs also are in good order. Guam's economy continues favorable. In the Trust Territory, a stabilization fund has assured Micronesians a steady income from copra despite declining prices.

BUREAU OF INDIAN AFFAIRS

Glenn L. Emmons, *Commissioner*



IN THE BUREAU of Indian Affairs continued progress was made in 1957 toward the ultimate goal of full educational and economic opportunities for Indian people.

Enrollment of Indian children in schools of all types reached a record total of about 132,000. On the Navajo Reservation, where lack of facilities was a problem of major proportions just a few years ago, the enrollment was stepped up by nearly 7 percent over the preceding year and passed the 27,000 mark. Active steps were also taken in 1957 to enlarge schooling opportunities in two other areas where lack of facilities has been a problem—the Choctaw jurisdiction of Mississippi and the Territory of Alaska.

In addition, greater attention than ever before was given to the educational needs of Indian adults. The special literacy training program, which the Bureau launched on five reservations in 1956, was continued in 1957 and expanded to include additional tribal groups in Arizona, New Mexico, and Alaska. Plans were also shaped up for initiating in the 1958 fiscal year an adult vocational training program as authorized by Public Law 959, approved August 3, 1956. Although the law authorizes annual appropriations of \$3,500,000, an appropriation of \$1,500,000 was requested for the first year of operations.

On the economic side one of the most important developments of the year was the establishment of eight industrial plants in the vicinity of Indian reservations in addition to the furniture factory at Gallup, N. Mex., and the leather goods plant at Cherokee, N. C., which were set up in 1956. Two of the new plants are in Arizona, providing employment for Navajo, Pima, and Papago Indians; three in South Dakota (including the reopened Flandreau garment factory) near the Sioux reservations; and one each in Montana, North Carolina, and Washington. Altogether they are expected to train and employ perhaps as many as 700 Indian workers in 1958.



FIGURE 21.—Through the use of trailer schools education was brought for the first time to some of the remoter parts of the huge Navajo Reservation in Arizona and New Mexico.

Meanwhile an increasing number of people on the reservations evidenced an interest in the broader economic and social opportunities available in metropolitan areas and requested Bureau assistance in relocating, either singly or in family groups, to cities such as Los Angeles, Denver, Chicago, and St. Louis. Nearly 7,000 persons (including 1,302 family units and 1,580 unattached individuals) received assistance under the relocation services program as compared with slightly over 5,000 in 1956. At the close of the period plans were being made to open new field offices in suburban communities such as Joliet and Waukegan, Ill., and to expand relocation service operations into States such as Ohio and possibly Texas.

Income to the Indian people from the direct use or leasing of their lands and other resources on the reservations mounted to impressive totals. As usual, however, some groups and individuals benefitted far more heavily than others. With the Navajo Tribe receiving

nearly \$35 million from bonuses on oil leases, chiefly in the "four corners" area of the reservation, the total income to all tribal groups and individuals from mineral leasing soared to an all-time high of over \$75 million. This compares with about \$43 million in 1956. Income from timber sales also reached a new high of more than \$14 million which was 23 percent greater than the record total of the preceding year. Agricultural and grazing income showed no substantial change.

Under the heading of "readjustment legislation" (i. e., legislation providing for the gradual assumption of full autonomy by the affected tribal groups) there were several important developments. Of the six groups covered by readjustment laws passed in 1954, two more reached the stage of final severance from Federal trusteeship. These were the coastal Oregon tribes of the former Grand Ronde-Siletz jurisdiction and four small Paiute bands of Utah. The Alabama-Coushatta group of Texas had already moved out from under Federal trusteeship one year earlier. This left the Menominee of Wisconsin, the Klamath of Oregon and the "mixed blood" Utes of Utah still facing terminal dates in the comparatively near future. Three additional groups—the Wyandotte, Peoria and Ottawa Tribes of Oklahoma—are now covered by readjustment laws enacted during the year in response to their own requests.

NAVAJO-HOPI REHABILITATION

In its seventh year of operations, the 10-year special program authorized by the Navajo-Hopi Rehabilitation Act of 1950 was, to a large extent, merged into the broader pattern of Indian Bureau activities in the two tribal areas. While the funds for the 10-year program work were handled separately and were charged against the authorizations set up under various categorical headings in the 1950 law, the work itself represented only a part—and, in most spheres of action, a minor part—of the Bureau's total program for the benefit of the two tribal groups.

As indicated in last year's report, funds transferred to the Public Health Service by the Indian Bureau in 1956 for the construction of health facilities exhausted the \$4,750,000 authorization for "hospital and health facilities" originally established in the Rehabilitation Act. In 1957 the available funds were used by the Health Service for the construction of health centers at five localities and the expansion and renovation of clinics at three others. In addition, funds were allocated for the construction of a 200-bed medical center at Gallup, N. Mex., and a new 75-bed hospital at Shiprock, N. Mex., near the northeast corner of the Navajo Reservation. None of these projects was completed during the year.

Under the heading of school construction, work moved forward on 13 projects authorized the preceding year which will eventually enlarge the capacity of reservation schools by 442 students. Four additional projects were authorized in 1957 bringing the total amount allocated up to \$24,527,295 of the original \$25 million authorization for school construction and similar work. The basic goal is to provide school accommodations near the home for all Navajo children through grade 6 and to arrange public schooling either on or off the reservation for those in the higher grades.

Most of the irrigation work accomplished during the year was on the Hogback project where \$341,579 was used to repair the rock-filled diversion dam, increase the discharge capacity and construct a concrete sluiceway and control works. Meanwhile the Navajo Tribe initiated a training program in irrigation farming techniques on the Hogback project with a group of 16 trainees.

Roadbuilding funds appropriated under the 1950 authorization were used in 1957 chiefly for continuation of work on Route 3 which will eventually cross the Navajo Reservation from Window Rock on the east to Tuba City on the west for a distance of over 125 miles. The 1957 accomplishments included the grading, drainage and surfacing of 11.4 miles from Tuba City to Coal Mine Mesa, construction of a bridge across Ganado Wash, and widening of a bridge spanning Fish Wash. Work was also initiated on the construction of a bridge across Chinle Wash at a point 75 miles west of Shiprock, N. Mex. In addition, the road funds were used to build airstrips at three isolated school localities and to improve the existing strips at three others.

In the sphere of soil conservation and range improvement work, major emphasis was placed on eradication of juniper and sagebrush, development of water-spreading structures, and reseeding of the range. The \$707,540 of program funds allocated for this work in 1957 was supplemented by \$87,000 of tribal funds and by \$200,000 from the Agricultural Conservation and Stabilization Service. Navajo land users themselves contributed labor and materials valued at over \$1,100,000.

The industrial development phase of the rehabilitation program, which started out with major emphasis on the creation of small tribally operated enterprises on the reservation, has now been reoriented, with full tribal concurrence, into a program designed to induce established private industries to locate subsidiary plants in areas adjoining the reservation. The Tribal Council has pledged to collaborate with neighboring communities in providing necessary plant facilities, subsidizing employee training, and offering other attractions. In 1956 the tribe employed an industrial manager, set up an industrialization department in its tribal administration, and began collaborating with peripheral communities. In 1957 the tribe ap-

propriated an additional \$300,000 of its own funds for a continuation of this program.

Minor allocations of Rehabilitation Act funds were made in 1957 for other phases of the program such as voluntary resettlement of Navajo and Hopi families on the Colorado River irrigation project, surveys and studies, and off-reservations relocation.

PROGRAMMING FOR SOCIAL AND ECONOMIC PROGRESS

Efforts to encourage the Indian tribes to work out and adopt programs for their own social and economic betterment, initiated by the Commissioner's memorandum of April 12, 1956, were pushed forward throughout the year. The Commissioner personally spearheaded the movement by holding, between July and December, 1956, a series of consultative meetings throughout the West with elected officers of nearly all the major tribes.

Meanwhile, the work was also going forward at the "grassroots" or reservation level. Thousands of copies of the memorandum were distributed to the Indians. Hundreds of meetings were held during the year to many of which State and county officials were invited to join with the Indians in discussing their community problems and devising programs which would contribute to their solution. Emphasis was laid, in this initial phase, on the necessity of (a) organizing the tribes for programming, and (b) assembling basic data on present conditions and needs.

In sum, a new awareness was created among the Indians regarding opportunities for self-improvement and community development, which, in many cases, exist at their very doorstep. Some embraced these opportunities eagerly; others held back. But a significant beginning was made.

Dalles Dam Settlement Fund

The Yakima Tribe of Washington, the Confederated Tribes of the Warm Springs Reservation and the Umatilla Tribes, both of Oregon, and the Nez Perce Tribe of Idaho were awarded a total of about \$27 million for the loss of their treaty rights to fish at Celilo Falls on the Columbia River. Construction of the Dalles Dam by the Corps of Engineers, authorized by the River and Harbor Act of May 17, 1950 (64 Stat. 163-179), flooded out the fishing grounds.

The Bureau regards the Dalles Dam settlement fund as a capital asset and not as regular income from which per capita payments may be made to meet current expenses. It has therefore advised the tribes to plan to use their shares of the fund in long-term constructive pro-

grams. Once approved categories of allowable expenditures have been agreed upon, modest per capitas are being approved for debt clearance and other immediate needs; then the balance is to be programmed on an individual or family basis for land acquisition, home improvements, business investments, trust funds for minors, education allowances, and other constructive uses. The Nez Perce and the Warm Springs Tribes have adopted programs along this line; the other two tribes are in the process of planning.

Fort Mojave Constitution

On November 14, 1955, a proposed constitution and by-laws for the Fort Mojave Tribe of the Fort Mojave Reservation of Arizona, Nevada, and California was submitted for consideration. This proposed document was returned to the tribes on August 13, 1956, by the Secretary to permit the tribe to hold an election for its ratification. The tribal constitution was adopted in an election held on March 16, 1957, by a vote of 121 for, and 13 against, and became effective on May 6, 1957.

LEGISLATIVE DEVELOPMENTS

Missouri River Basin

Among the significant legislative items of the year were bills to provide for the rehabilitation of all enrolled members of the Crow Creek and Lower Brule Sioux Tribes of South Dakota, portions of whose reservations have already been taken for the Fort Randall Reservoir on the Missouri River. These bills follow the lines of legislation already enacted to aid the Fort Berthold and Cheyenne River Tribes, many of whose members were necessarily displaced and much of whose land was acquired for reservoirs farther up the river.

A bill to provide for the acquisition of lands by the United States required for the reservoir created by the construction of Oahe Dam on the Missouri River and for rehabilitation of the tribal members of the Standing Rock Sioux Reservation in South Dakota and North Dakota was also introduced. The bill would authorize an appropriation for rehabilitation of all enrolled members of the tribe. The value of land and improvements and indirect damages would be determined by negotiation between representatives of the Corps of Engineers and the Tribal Council subject to approval by the Secretary of the Interior.

New Readjustment Legislation

At the request of the Indian groups affected, a bill (H. R. 6364) was introduced to distribute the assets of 31 of the 115 rancherias

in California for the benefit of the individual Indians. It would enable the Indians on the rancherias named to work out, with the approval of the Secretary, a plan for the distribution. No time limit is set. The Secretary would be authorized to make surveys, complete roads and water systems, and help the rancheria residents to form a legal entity to accept title to the property. Distribution could be accomplished either by transferring title for the lands to a legal entity representing the group, or by selling the lands and dividing the proceeds among the members. When the distribution is completed, the Indians participating would no longer be entitled to services provided to Indians by the Bureau.

In August 1956, Congress enacted readjustment or termination laws for three small tribal groups in northeastern Oklahoma: (1) the Wyandotte Tribe (Public Law 887); (2) Peoria Tribe (Public Law 921); and (3) the Ottawa Tribe (Public Law 943). These tribes approved and requested the terminal legislation prior to enactment. The proposed rolls for the Wyandotte and Peoria Tribes have been published in the Federal Register. The Ottawa's roll was awaiting approval of the Secretary at the end of the fiscal year.

READJUSTMENT PROGRESS

Federal trusteeship of two Indian groups was ended during the year. On August 18, 1956, the Secretary announced the removal of Federal supervision of the Western Oregon Indians in accordance with Public Law 588, 83d Congress, August 13, 1954 (68 Stat. 724). On March 1, 1957, he issued a similar proclamation regarding four Paiute bands of Utah in accordance with Public Law 762, 83d Congress, September 1, 1954 (68 Stat. 1099). These terminations involved a total of 2,332 Indians (2,100 in Oregon and 232 in Utah) and a total of 46,003 acres of tribal land (3,164 in Oregon and 42,839 in Utah.)

Menominees of Wisconsin

Shortly after the beginning of fiscal year 1957, the President signed into law two acts amending the 1954 legislation (Public Law 399, 83d Cong.) to terminate the special Federal trusteeship over the property and affairs of the Menominee Tribe of Wisconsin. The act of July 14, 1956, authorized appropriation of Federal funds to reimburse the Menominees for costs incurred in the 1954-58 transitional period insofar as those tribal expenses are a direct result of planning for unrestricted status. The Department immediately requested the appropriation of \$500,000 to be made available for such reimbursement; and the Congress allowed an amount of up to \$300,000 to be available until expended for assisting the tribe.

Also approved on July 14, 1956, was Public Law 718, 84th Congress, "Relating to the plan for control of the property of the Menominee Indian Tribe, and for other purposes." This amendment requires the Menominee Tribe to submit to the Secretary its plan for taking unrestricted custody of its property not later than December 31, 1957, which is 1 year prior to the statutory limit for the ending of Federal trusteeship. The congressional action also stipulated that the tribe's plan shall provide for the management of the Menominee forest on a sustained yield basis, and for the protection of the water, soil, fish and wildlife. In addition, this law gives the Secretary of the Interior discretion to transfer federally owned property on the reservation to the tribe, or its members, or to a public or nonprofit body for Indian use, without regard to the other laws governing the disposal of Federal property.

Klamaths of Oregon

The Commissioner developed in 1957 trusteeship procedures for carrying out the protective requirements of Public Law 587, of August 13, 1954 (68 Stat. 718). Trust banks will reduce fee expenses for trusts and yet provide necessary and adequate protective measures. Appraisal of the Klamath tribal assets was completed and action is being taken to carry out the subsequent requirements of the act.

Recognizing the many problems on the Klamath Reservation in carrying out the provisions of Public Law 587, including the possible destruction of a great natural resource, the Department of the Interior, by Executive communication of January 7, 1957, submitted a proposal to modify and amend the act. This amendment would postpone the sale of tribal assets until the end of the 2d session of the 85th Congress. A number of technical changes are also involved.

Utes of the Uintah and Ouray Reservation

Public Law 671 of August 27, 1954 (68 Stat. 868), provided for (1) distribution of the assets of the Ute Tribe of the Uintah and Ouray Reservation in Utah between the mixed-blood and full-blood members, (2) termination of Federal supervision over property of the mixed-bloods, and (3) a development program for the full-bloods.

Agreement between the mixed-bloods and full-bloods was reached during the year on division of tribal funds, credit activities, tribal enterprises, buildings, equipment, supplies, and range areas. This left only the timber and agricultural lands still to be divided. A number of factors, such as the pending redesignation of the irrigation project, delayed completion of the division within the 1-year period. An extension of time has been granted the two groups,

permitting them to complete their division work by not later than December 4, 1957. The full-bloods have adopted a long-range program which emphasizes the development of family planning, resources, credit, health, and education. It was approved by the Bureau on December 14, 1956.

Confederated Tribes of the Colville Reservation, Washington

Public Law 772 of July 24, 1956 (70 Stat. 626) restored to the Confederated Tribes of the Colville Reservation, Washington, ownership of 818,000 acres of ceded lands which had not been disposed of. The act also provides that the Business Council of the tribes, in line with its own resolution of April 8, 1955, shall submit within 5 years from the enactment date a plan for terminating Federal supervision. During the past year the Bureau and tribal officers agreed on procedures for determining the status of mining claims within the reservation, and plans for an overall survey of human and economic resources and a study of property titles.

INDUSTRIAL DEVELOPMENT

In its second year of operation the Bureau's industrial development program registered considerable progress in encouraging the establishment of small plants on or near reservations for the employment of Indian workers. Contacts were made by the Commissioner's assistant and representatives with numerous industries from New York to Los Angeles in the fields of electronics, textiles, metal fabrication, woodworking, plastics, and many others.

Negotiations continued toward expansion of (1) the previously established Navajo Furniture Industries, Inc., in Gallup, N. Mex., which employs Navajos to manufacture juvenile furniture, and (2) the plant set up by Saddlecraft, Inc., on the Cherokee Reservation which employs Eastern Cherokees to manufacture moccasins and other leather goods. Each of these plants expects to provide on-the-job training for 100 Indians in fiscal 1958.

In addition, seven new plants were opened on the periphery of reservations and one factory formerly operated by the Bureau was reopened under private auspices.

Lear, Inc., of Santa Monica, Calif., established Lear-Navajo at Flagstaff, Ariz., for the assembly of electronic components.

Parsons & Baker Co., of Phoenixville, Pa., established Casa Grande Mills at Casa Grande, Ariz., which manufactures knitted garments. The company is presently steadily employing Pima and Papago Indians and anticipates training 100 Indians in 1958.



FIGURE 22.—The Indian Bureau's industrial development program brought new job opportunities to reservation Indians in 1957. A factory making leather goods at Cherokee, N. C., was one of 10 such plants in operation.

The First Americans, Inc., was established at Lame Deer, Mont., to employ Northern Cheyenne Indians for the production of woodwork, plastics, and electronics. This plant is steadily expanding and anticipates training 125 Indians during the year.

New Moon Homes, Inc., of Alma, Mich., established a plant in Rapid City, S. Dak., to manufacture house trailers. The company anticipates training 100 Sioux Indians in 1958.

Tatanka, Inc., of McLaughlin, S. Dak., was established to manufacture toys and other woodwork. Steady employment is being given to Standing Rock Indians and future plans contemplate training 50 Indians.

Whitetree's Workshop on the Cherokee Reservation, N. C., is currently employing Eastern Cherokees in the manufacture of souvenir items and will train 30 Indians during the year.

Bayly Manufacturing Co., Yakima, Wash., has expanded its garment-manufacturing operations and anticipates training 100 Yakima Indians.

The Flandreau Garment Factory at Flandreau, S. Dak., has been reopened and will employ approximately 25 Sioux Indians in the manufacture of ladies apparel.

On-the-job training agreements were negotiated with the various companies participating in the industrial development program to be effective July 1, 1957, as authorized by Public Law 959, 84th Congress, approved August 3, 1956.

At the close of the period, additional negotiations were being actively carried forward by the Bureau with numerous industrial companies, looking toward the establishment of plants near Indian population centers in Arizona, Minnesota, Montana, New Mexico, North Dakota, Oklahoma, South Dakota, and Wyoming.

EDUCATION

Approximately 124,000 Indian children of school age, 6 to 18 years, were enrolled in public, Federal, mission, and other private schools in fiscal year 1957. About 60 percent attended public schools, 31 percent were in Federal schools, and 9 percent in mission and other private schools. Public school enrollment increased by an estimated 2,900 students in line with Bureau policy of transferring classes and schools from Federal to public school jurisdiction where feasible. In addition, there were approximately 5,300 Indian children under 6 and over 18 years of age enrolled in school, the majority in Federal schools.

Indian children are eligible to attend public schools on the same basis as other citizen children; however, tax-exempt, Indian-owned lands and large numbers of Indian students within school districts may create financial burdens for which local funds are inadequate. In these cases, the Bureau has authority under the Johnson-O'Malley Act (48 Stat. 596) to contract with States or local school districts and provide financial aid. State and local contracts were negotiated during the year in 19 States and the Territory of Alaska to assist financially in the public school education of approximately 40,000 Indian students.

New construction and expansion of present Federal school facilities is required to provide for the rapid increase in population, to absorb the backlog of school-age children not enrolled in any school, and to relieve excessive overcrowding. Long-range projection of school building needs has been charted and will be adjusted annually as warranted.

The Bureau of Indian Affairs operated 79 boarding and 229 day schools in fiscal 1957. The day schools include 12 instructional aid schools in Alaska, and 1 hogan and 2 literacy units on the Navajo Reservation. Classes were conducted for patients in 4 Indian hos-

pitals operated by the Public Health Service, and dormitory accommodations were provided for 2,900 students attending public school in 16 locations.

Progress in the educational field on the Navajo Reservation was slightly greater than that achieved in 1956, a record year. Enrollment increased by 6.83 percent as compared to an increase of 6.79 percent for the preceding year and reached an all-time record of 27,013 students. The approximately 7 percent annual increase in Navajo enrollment may be compared with an annual increase of about 4 percent for the Nation as a whole. Enrollment includes students attending reservation day and boarding schools; mission and other private schools, public schools of the peripheral communities; and off-reservation Federal boarding schools in Arizona, California, Kansas, Nevada, New Mexico, Oklahoma, Oregon, and Utah.

Of the Navajo school-age children enrolled in the 1956-57 school year, 32.2 percent were in public schools, 61.4 percent in Federal schools, and 6.4 percent in mission and other private schools. Of the approximately 8,300 attending public schools, 1,460 lived in Federal dormitories in 6 towns bordering the reservation.

The number of school-age Navajos not enrolled in any school was decreased by more than 1,700 in fiscal year 1957 to a record low figure of 3,098.

Improvement of Standards

In 1957 the Bureau emphasized better management of its schools through development of standards in construction, school operations, and a supervisory evaluation guide.

On the construction side, standards were developed for space requirements for classrooms, dormitories, kitchens, dining rooms, bath rooms, and outdoor play areas. These standards will assure uniform planning of school facilities and will greatly reduce cost in terms of time and money spent in the preparation of preliminary drawings and estimates. A master list of essential major equipment and supplies for Indian schools, also compiled in 1957, will facilitate procurement of necessary items at reasonable cost and with minimum delay.

Over the past 4 years the Bureau has been developing criteria which may be used by each of its schools for evaluating their own operations. In 1957 the criteria were used in evaluating operations at four boarding schools and 14 day schools. Revision and refinement of the criteria were made following each use and the criteria have now reached the stage where they can be formalized and used throughout the Bureau in supervisory evaluation of school operations.

Adult Education

During the year the Bureau continued to operate and expand its pilot program in adult education which was started during the previous year in 5 tribal jurisdictions where the need was especially acute. These are the Seminole of Florida, the Papago of Arizona, the Turtle Mountain Chippewas of North Dakota, the Rosebud Sioux of South Dakota, and the Shoshone-Bannock at Fort Hall in Idaho. Additional projects were initiated during 1957 in the Navajo and Pueblo areas of Arizona and New Mexico, at the Tacoma Sanatorium in the State of Washington, and among the native Alaskan groups.

The adult education program is operated for the purpose of reaching the large group of adult Indians who are disadvantaged by lack of schooling and who need and desire help in adjusting to modern life: in the development of social, economic, and civic understanding; and in the improvement of language and numerical skills. The instructional content of the program is broad in scope and limited in content only by what adult Indians want to learn and the teaching staff is qualified to teach. In most cases it would encompass much more than mere instructions in speaking, reading, and writing the English language. It aims at serving educationally the everyday needs of adult Indians.



FIGURE 23.—Adult Indians who missed the opportunities of education in childhood get their chance today in this special Indian Bureau class on the Brighton (Seminole) Reservation in Florida.

Under most of the readjustment laws which have been enacted, the Secretary is authorized to undertake a special program of adult education and training designed to help members of the tribe to earn a livelihood, to conduct their own affairs, and to assume their responsibilities as citizens without special services because of their status as Indians.

Under this authority the Bureau has contracted for appropriate terminal education programs for the west coast Indians and the Klamaths in Oregon, the four Paiute bands and the Ute mixed-blood groups in Utah, and the Menominee Tribe in Wisconsin. In addition, a limited program has been initiated under direct Bureau sponsorship to accommodate the special adult training needs of individuals in the Wyandotte, Peoria, and Ottawa tribes in Oklahoma which are under terminal legislation.

In-Service Training

To provide in-service training for education personnel at the operating level, area administrators, assisted by local and central office technicians, conducted some 30 workshops during the year, in which more than 2,000 employees participated. The participants came from many areas, from Alaska to Cherokee, N. C., some assembling in large groups, others in small groups, but all for the same purpose—that of seeking ways to improve all facets of the education program provided for Indian people.

In addition to these local workshops an important conference of school administrators, technicians, and tribal representatives was held in June to explore methods and techniques designed to raise the educational level of Indian people so that they can compete in the age of automation. In keeping with the Commissioner's policy of consultation with Indian groups, school officials were assisted and counseled by 17 tribal representatives. Minimum criteria for translating ideas into action were developed, educational policy for the various areas was drafted for approval through appropriate channels, and a collection of various opinions compiled relative to Indian needs.

Aids to Higher Education

In fiscal 1957 new scholarships for Indians were established by a number of private organizations and schools. Some tribal organizations also provided new scholarship grant programs while others increased the amounts already authorized for this purpose. The largest grant program was made by the Navajo Tribe, which estab-

lished a \$5 million trust fund, the income to be used for higher education grants. Since no income has been realized from this fund, the tribe has increased its present grant program to \$200,000 for the fiscal year 1958. The Bureau also continued making small grants to assist qualified Indian youth in education beyond the high school level.

WELFARE

In 1957 there was increasing recognition of the need (1) for social services on reservations to prevent breakdown in family life which contributes to child neglect and juvenile delinquency and (2) for work with families toward self-support and improvement in standard of living through proper use of income. While financial assistance to needy Indians remains a basic activity of the Bureau's welfare program, there has been a growing demand for social services based on the broader objectives of preventing family disintegration and dependency. Work has continued with the leaders of tribes receiving substantial income from tribal assets to develop programs which will protect and conserve the income of minors and members who are non compos mentis or in need of assistance in managing their affairs.

While many Indians need help in establishing their legal status in matters of marriage, divorce, adoptions, and guardianship, and similar relationships, this is particularly important in tribes covered by readjustment legislation. Under terms of the legislation providing for termination of Federal supervision over trust property of the Indians of western Oregon and the Paiute bands of Utah, measures were taken under State law to protect the property of members who are minors, non compos mentis, or in need of assistance in conducting their affairs, prior to transfer or removal of restrictions from such property. Effective action also is being taken within the terms of Klamath legislation and the Uintah and Ouray Ute Tribes readjustment legislation over the affairs of the mixed bloods, to obtain protection under State law for needy members of those tribal groups.

General Assistance

In 1957 the general assistance program met increased needs in Oklahoma and the Southwest and in Montana due to severe drouth conditions. In Alaska referrals of tuberculous patients from the United States Public Health Service continued and the case-finding operations of that agency resulted in a steadily high caseload consisting of dependents of hospitalized patients. Offsets to these increased requests for general assistance were found in the Northern Plains

States which again enjoyed mild winter weather. The general assistance monthly caseload averaged 2,813 cases consisting of 7,548 persons. The average monthly grant was \$60.14 per household.

One noteworthy development was the increased responsibility assumed by the Navajo Tribe to meet relief needs of tribal members. Among the items provided were clothing for school children, emergency assistance, provision of housing materials for house repairs or home additions and for medical appliances. A number of other tribes with considerable resources continued to assume responsibility for financing the general assistance program for their needy members while some in the Dakota area continued to distribute surplus food commodities on their reservations.

Services to Children

Child welfare services of the Bureau have been aimed at providing for dependent or neglected children either in their own homes, or in foster homes when placement outside the home has been indicated. In 1957 emphasis was continued on planning for younger children to remain in their own homes and attend public school, wherever possible, rather than enroll in Federal boarding schools. Social workers reviewed the situation of children already enrolled in boarding schools and the applications for enrollment which were based on social rather than educational reasons to determine if the children could be assisted to remain in their own homes or the homes of interested relatives. Through provision of aid to dependent children or other assistance, some children were enabled to remain with their families or relatives. Emphasis also continued on finding appropriate institutional care for children with handicaps, such as mental retardation, deafness, blindness, or cerebral palsy.

RELOCATION SERVICES

Of the Indian people who applied in fiscal 1957 for relocation services, 6,964 were assisted to relocate in six cities where the Bureau maintained field relocation offices: Chicago, Ill.; Denver, Colo.; Los Angeles, San Francisco and San Jose, Calif.; and St. Louis, Mo. The total included 5,384 individuals in 1,302 family units, 1,166 unattached men, and 414 unattached women. This represents an increase of 36 percent over fiscal 1956.

Financial assistance was extended to 6,543 persons to cover all or a portion of the cost of relocation. An additional 421 individuals availed themselves of the employment and community adjustment services but were not granted financial assistance.

On the reservation end of the relocation process, services were provided at 43 agency jurisdictions, some of which served smaller nearby agencies on an itinerant basis.

The great majority of the relocated Indians are making satisfactory adjustments in their new locations as evidenced by their many letters to relatives and friends back on the reservations. They have been assisted in securing employment with several thousand different employers in diversified industries and have given satisfaction as workers. The capabilities of Indian workers are becoming better known and many employers are asking for additional people. Letters have been received from a number of employers testifying to their satisfaction. This success in adjustment as employees has secured acceptance of Indians as workers in some firms which had never employed Indians before, and has played an important part in broadening the scope of the program.

At the reservations there continues to be a very active interest in relocation services. At most agencies there is a constant backlog of applicants waiting for assistance. Tribal councils, in general, agree that relocation service is a necessary function and one which provides some members of their tribes with a badly needed opportunity to gain greater economic security than is possible on the reservation. The service is being accepted as one of the necessary tools with which each tribal group can work in planning a long-range program to help Indian people to establish themselves as self-sufficient citizens.

LAW AND ORDER

The States of South Dakota and Washington both acted in fiscal year 1957 pursuant to Public Law 280, 83d Congress, to assume civil and criminal jurisdiction over Indian lands within their borders.

The South Dakota law provides that such jurisdiction will be assumed or accepted only after favorable action has been taken by the board of county commissioners of the particular county and after the commissioners have negotiated a contract with the Bureau of Indian Affairs for reimbursement of the costs to the county involved. At present the Bureau has no authority to participate in such a contract. This law also gives the Indian tribes of South Dakota one year from October 1, 1957, in which to conduct a referendum on whether or not they wish the extension of such jurisdiction to their respective reservations. If they fail to hold such a referendum within that time, the counties may proceed to assume jurisdiction as provided in the law.

The Washington State law provides that the Governor shall, upon a petition by the tribal council, proclaim the assumption of such jurisdiction. In the case of the Colville, Spokane, and Yakima reservations, the tribal council petitions must also be supported by a

favorable referendum vote of the membership at large. At the close of this fiscal year two tribes not covered by the referendum provision—Muckleshoot and Skokomish—had petitioned the Governor of Washington for the extension of State jurisdiction to their lands.

The San Carlos Apache Tribe was the only tribe to take positive action in 1957 to enact an ordinance to legalize intoxicating liquor on a reservation. The resolution to put this into effect came in during the closing weeks of the fiscal year and was not finally acted upon by June 30.

The staffing of the new positions, permitted by increased appropriations by the Congress, in the several areas for the maintenance of law and order were mostly completed within the first quarter of the fiscal year. This, together with more funds available for the care of Indian prisoners and operating expenses, has substantially added to better law enforcement on many reservations.

REALTY OPERATIONS

To attain greater efficiency in the trust supervision over Indian lands, the Bureau in 1957 moved forward with a reorganization of its realty activities in both central and field offices on more purely functional lines. This realignment, when fully established in all offices, will provide the basis for (1) facilitating the orderly withdrawal of Federal supervision over trust or restricted lands in accordance with enacted readjustment legislation; (2) development of natural resources to maximum capacity while under trust status; and (3) development of full capabilities of the industrial, agricultural, recreational, and business potential of these lands to assume maximum compensable benefits while under Federal supervision.

Acquisition and Disposal

Major accomplishments under this heading in fiscal 1957 included: (1) the purchase of a 98,000-acre tract in Arizona for use by the Navajo Tribe in connection with its ram herd development program, (2) the determination of ownerships on a number of California rancherias in anticipation of readjustment legislation as sought by the Indians, and (3) the buildup of a realty staff at Palm Springs, Calif., to work on the problem of equalizing allotments on the Agua Caliente Reservation.

During the year the Bureau processed a total of 10,243 realty transactions in compliance with requests made by the Indian owners. Of these, 8,065 cases involving 325,314 acres resulted in removal of the lands from trust or restricted status. Supervised sales made at the request of the Indian owners, with the fee title conveyed to the

non-Indian purchasers, accounted for 200,084 acres; issuance of fee patents (or unrestricted titles) to Indian applicants who proved their competency accounted for 91,344 acres; certificates of competency to qualified Indian applicants for 8,144; order removing restrictions as requested for 7,462; and other methods for 18,280.

In addition, 2,178 transactions were completed during the year which had no material effect on the overall acreage of land in trust or restricted status. These included exchanges between individual Indians, between individuals and tribes, between Indians and non-Indians and partitions of allotments among several Indian owners. These transactions, in part, assisted individuals in obtaining land for homes and blocking out economic and better units for operations.

Tenure and Management

Under this heading one of the important functions is processing requests for rights-of-way across Indian lands. In 1957 the Bureau processed 1,640 cases of this kind as compared with 1,448 in 1956. Regulations governing the granting of powerline rights-of-way were modified during the year to facilitate the handling of cases where lines carry less than 33 kilowatts.

At the close of the year there were 31,366 leases or permits of all kinds in force and effect on Indian lands, covering 3,423,911 acres and providing an annual rental of \$8,411,452 for the Indian owners. These cover the use of Indian lands for farming, farm pasture, grazing, or business purposes. They do not include Indian lands incorporated in range units. The long-term leasing act of August 9, 1955 (69 Stat. 539), has brought about an interest in developing certain Indian lands where the cost of development could not be amortized under the shorter tenure permitted by previous legislation.

With the steady growth of population in the United States and the consequent demand for new agricultural areas for development in the West, there has been a fairly uniform demand for the leasing of Indian agricultural lands, and a great many individual Indian people for whom the United States holds lands in trust have derived a substantial portion of their income, just as do their non-Indian neighbors, from the rentals of their lands.

Certain conditions, unique to the title patterns with which Indian allotments are encumbered, contribute in a large measure to the high percentage of allotted Indian farmland used by non-Indians under leases. Because the United States has been required to hold title in trust for succeeding generations of heirs of original Indian allottees, a large percentage, considerably more than half, of the allotments, are now held in multiple ownership. In extreme cases, the number of heirs may run as high as several hundred.

As a result, use of allotted lands by any one of the owners, where the title is thus complicated, is rendered exceedingly difficult because of normal disagreement between the heirs and, further, because of lack of adequate finances for any one of the heirs to acquire the interests of the other heirs or to pay a satisfactory rate of rental. Consequently, most of the allotments in that status are leased to non-Indians. This condition exists primarily throughout the Midwest and the Northern Great Plains areas where a high percentage of the land has been allotted to individual Indians. Of the Indian lands classified as farmland, less than 30 percent (995,000 acres) is used by Indians, and the balance (over 2,500,000 acres) is used by non-Indians under lease or permit.

This situation does not prevail to as great an extent throughout the Southwest where most of the lands are still in tribal ownership and where the lands are predominantly usable only for grazing. Bureau records show that the Indians are using more than 33,200,000 acres of rangeland there and elsewhere throughout the Indian country as against non-Indian use of approximately 8,700,000 acres.

Minerals

The income received by Indians from the mineral leasing of their lands reached an all-time high of \$75,592,015 in fiscal year 1957. This was about \$31 million or 72 percent greater than the amount reported in the previous fiscal year.

The proceeds from oil and gas leases amounted to \$72,616,644. The outstanding oil and gas developments on Indian lands during the year took place in the Four Corners area of Arizona, New Mexico, Utah, and Colorado. Advertised sales of leases on Navajo lands in this area brought nearly \$35 million in bonus payments. In addition, the Ute Indians in Colorado and New Mexico portions of the Four Corners realized about \$12 million in bonuses. These bonuses alone exceeded the entire income from oil and gas operations on Indian lands for any preceding year.

In addition, there was extensive development during the year on the Jicarilla Reservation in New Mexico largely as a result of gas pipelines to California and the Pacific Northwest. Indian lands in Oklahoma continued to lead in oil and gas production. Oil and gas development on Indian reservations in Montana and Wyoming remained comparatively steady.

The total income from oil and gas on all Indian lands was comprised of the following items:

| | |
|---|----------------|
| Bonus received from lease sales..... | \$49, 548, 745 |
| Royalties on production..... | 18, 492, 432 |
| Annual rental for lands held under lease..... | 4, 575, 467 |

The total income for minerals other than oil and gas amounted to \$2,975,371. On the San Xavier Reservation, Arizona, a high bid of slightly in excess of \$1 million was received for three preferential prospecting permits. The interest in uranium development in Arizona and New Mexico continued steady. The Jackpile uranium mine on the Laguna Pueblo, one of the largest uranium mines in the United States, brought a royalty income of approximately \$2,066,503 to the Pueblo. Lesser incomes were realized from lead and zinc leases on the Quapaw Reservation, Oklahoma, and from phosphate leases on the Fort Hall Reservation, Idaho.

IRRIGATION

During fiscal 1957 approximately 4,800 acres of land were provided with new irrigation facilities and an additional 7,000 acres were provided with a stable and supplemental water supply through the rehabilitation of previously constructed systems. The work during the year involved the drilling and equipping of six new irrigation wells; the rehabilitation of 19 old wells; the drilling and equipping of 4 wells for combined irrigation and domestic water purposes; the construction, extension, rehabilitation, and replacement of 564 miles of canals and laterals; the concrete lining of 6.2 miles of laterals; the replacement, construction and rehabilitation of 1,090 structures of various sizes and types; the installation of 14,920 feet of steel and concrete pipeline; the excavation of 28 miles of drainage canals; the replacement of one 650-foot-long siphon; the installation of one 210-foot, 24-inch flume; and the realignment of approximately 5 miles of river channel. One large wasteway structure was completed and one is about half complete. In addition to the foregoing irrigation development work, 55 miles of power transmission and distribution lines were extended and replaced to serve an additional 256 customers on the Colorado River, Flathead, and San Carlos projects. Crops produced on the various projects during the calendar year 1956 were valued at \$55,265,484.

The more important irrigation developments during the fiscal year 1957 were as follows:

Colorado River Project, Arizona

The overall development program on the Colorado River Reservation involves the expansion of the irrigation project to its ultimate area of 100,000 acres. During fiscal 1957 intensive and comprehensive

surveys, investigations and studies were continued for the extension of the lateral and drainage systems. The construction of the Poston wasteway was started and about half finished. Other work consisted of enlarging and deepening existing drains and the extension of the power system approximately 3 miles.

San Carlos Project, Arizona

The extreme drought conditions experienced on this project over the past several years continued in fiscal 1957. Work on the project involved primarily the drilling and equipping of new wells and the rehabilitation of existing wells.

Fort Hall-Michaud Division, Idaho

This project was authorized under the act of August 31, 1954 (68 Stat. 1026). Construction by contract was started on this unit in fiscal 1957. The unit will eventually embrace 21,000 acres and is expected to cost about \$5,500,000.

Flathead Project, Montana

The work on this project consisted primarily of the continuation of the concrete lining of the Dry Creek, Polson pump and feeder canals.

Middle Rio Grande Pueblos, New Mexico

The land development and irrigation rehabilitation work authorized under the Flood Control Act of 1948 and its supplemental act of 1950 for the Pueblos within the Middle Rio Grande Conservancy District was started during fiscal 1957.

Engineering Plans and Surveys

In addition to the actual development work on the various projects, and the regular preliminary and preconstruction surveys, the Bureau also undertook several other tasks of a planning nature. These included surveys and investigations for rehabilitation and extension of the Pine River project in southern Colorado; initiation of preliminary surveys on Indian lands within the proposed Florida and Animas-LaPlata projects in northern New Mexico; and a considerable amount of work on the Navajo project consisting of investigations and planning incidental to the preparation of a supplemental report to the feasibility report dated January 1955.

FORESTRY

Noteworthy features in Indian forest management during 1957 included the receipt of a record-high income from the sale of Indian timber, an increase in funds provided for forest management, and the development of new procedures for recruiting forestry personnel. Forest management was also affected by the publication of a joint congressional committee report on "Federal Timber Sales Policies," and by another Senate committee's searching review of forest management practices on the Quinault Indian Reservation in Washington State.

Income from the sale of Indian timber during calendar 1956 exceeded \$14 million, an increase of 23 percent over the former record that was established in 1955. This income includes the value of stumpage used by three tribal sawmill enterprises. The greater income was received despite a 5 percent falloff in volume of timber sold.

There has been a general upward trend in the volume and value of Indian timber sales during the past decade. This trend is in harmony with the objective of placing all Indian forests in full production under sustained-yield management. In working toward this objective, the Bureau initiated several years ago a plan to inventory the Indian forests of commercial importance and, with these inventories, to recalculate the growth potential and allowable annual cut. This program was continued successfully in 1957. At the present rate of progress, acceptable information for all Indian forests of commercial importance should be available within the next 5 or 6 years.

The increasing volume of timber sale business has required an increase in forestry personnel. Furthermore, the competitive demand for timber offered for sale has substantially increased the prices being received for it. With the increase in value has come the need of more careful supervision of sales. This requires more man-years of effort in supervising the sale of a given volume of timber. Other forest managing agencies are faced with similar problems and, as a result, personnel recruitment difficulties have multiplied. The problem was partially solved during the past year, in cooperation with the Civil Service Commission, by raising the entrance salaries in the two lower grades, and through simplified recruiting methods.

RANGE, WILDLIFE, AND RECREATIONAL RESOURCES

The Indian range land is divided into range units and made available for use under permits which describe the maximum stocking, the proper season of use, and the conservation requirements necessary to

obtain the maximum use consistent with sustained forage production. The range land not needed for Indian use is offered to non-Indian operators on a competitive-bid basis.

Proper use of the range has been and continues to be a difficulty on large areas of tribally owned ranges in New Mexico and Arizona. In 1957 the San Carlos Apaches of Arizona passed a range ordinance which will assist in obtaining proper use. The attitude of the Indians is changing toward proper use where sufficient personnel and training aids are available to bring their attention to the need of maintaining the range resource.

TABLE 1.—*Range land use, 1956*

| | Acres | Percent | Cattle units | Percent | Value |
|----------------|------------|---------|--------------|---------|-------------|
| Total range | 44,000,000 | 100 | 886,000 | 100 | \$6,293,000 |
| Total use | 41,900,000 | 95 | 874,000 | 99 | 6,293,000 |
| Non-Indian use | 8,700,000 | 20 | 334,000 | 38 | 2,147,000 |
| Indian use | 33,200,000 | 75 | 540,000 | 61 | 4,046,000 |
| Not used | 2,100,000 | 5 | 12,000 | 1 | |

NOTE.—Total number grazing permits: 13,200.

Fish, wildlife, and recreation are gaining impetus on many of the Indian Reservations. Some of the tribes are beginning to realize that they have an excellent resource in demand by the public. Continued guidance in developing this resource will assist some of the tribes in obtaining returns from a resource which had been used only by individual Indian members.

TABLE 2.—*Fish and Wildlife—approximate income or value of 1956 harvest*

| | |
|---|-------------|
| Total all reservations | \$2,220,000 |
| Commercial fish | 461,000 |
| Domestic fish | 421,000 |
| Fur bearing animals | 148,000 |
| Game birds | 195,000 |
| Big game | 920,000 |
| Receipts from permits (fishing and hunting) | 75,000 |

SOIL AND MOISTURE CONSERVATION

In 1957 soil and moisture conservation work on Indian land had its best year since the program started in 1940. This is evidenced by the fact that 2,423 educational meetings on soil conservation were conducted with 72,017 Indian people attending. As a result of these meetings, 11,287 land use plans were developed covering 4,953,040 acres of farm and ranch land. To provide more grazing for livestock, brush was eradicated on 97,725 acres; seeding and sodding were accomplished on 159,018 acres and waterspreading on 52,385. Under the drought conditions, which have prevailed for the past several years over much of the West, waterspreading has increased forage produc-

tion ten times and more on areas where water was diverted from arroyos to adjacent parched range land.

The watershed protection program has been accelerated by the building of 1,020 detention dams, 56 miles of dikes, 800 diversions, 431 miles of terraces and bank protection work on 135 miles of stream to help prevent damage by rampant flood waters.

Development of the Indians' cultivated lands continued at a rapid pace during the year. Greater emphasis was placed on the use of vegetation to improve yields, conserve moisture and control wind and water erosion. Cropping systems on 2,939,419 acres served to improve the physical condition of the soil, add organic matter and rotate crops, thus providing greater infiltration of moisture, less runoff and greater yields. Residue management on 675,796 acres and strip cropping on 454,272 acres provided cover and protection from wind and water erosion. For additional ground cover and soil improvement, cover crops were used on 230,709 acres. To assure a good growth of soil improving and cover crops, 25,876 tons of fertilizer were applied.

This combination of vegetative conservation measures with mechanical measures such as terrace and contouring is essential to economically sound conservation farming.

One of the most important phases of the Bureau's soil and moisture conservation program involves the eradication of rangeland brush. Thousands of acres of Indian land in the United States are infested with brush that has little or no economic value and competes with the more desirable plants for available water and plant nutrients. It has been found that approximately seven times as much forage is produced in areas where the juniper and other undesirable brush have been removed as in areas that have not been treated.

One of the biggest brush eradication projects is on the Fort Apache Reservation in Arizona, which is heavily infested with juniper. The cost of treating juniper at Fort Apache has decreased from year to year as new and improved methods have been put into effect. In 1957 the cost per-acre for the eradication of juniper for all methods used (including burning, dozing, cabling, and hand chopping) amounted to \$5.83. Since the program was started in 1940 approximately 139,990 acres of juniper have been eradicated on the reservation. In 1957 the Bureau spent \$37,900 of soil and moisture conservation allotments and the Fort Apache Indians spent \$143,000 of their money in the juniper eradication program.

The Bureau is continuing to foster cooperation with the various soil conservation districts. During the past year an additional 114,804 acres of Indian land was included within soil conservation districts by formal agreements.

Indians are very anxious to promote soil conservation work on their land, and in many soil conservation districts one or more In-

dians are serving as district supervisors. In areas where soil conservation districts do not exist, Indians have organized their own soil conservation enterprises and associations to promote the conservation work on their lands. Altogether 21,345,691 acres of Indian land in 17 States and on 65 reservations are now covered by formal cooperative agreements with 176 soil conservation districts.

AGRICULTURAL EXTENSION

Apart from the States of Arizona, New Mexico, and Mississippi, where the Bureau is still responsible for direct extension work with Indians, this activity is now being conducted by State agricultural extension services under contractual arrangements.

Progress was made during fiscal 1957 in improved irrigation practices and introducing better production practices on farm lands, as well as in getting more acres into production which have not been in use. Extension educational activities designed to improve practices in management, breeding, and marketing of livestock were also stressed.

In this process, Bureau extension workers held or participated in 3,182 meetings with an attendance of 102,364 people; made approximately 14,381 farm calls; made 73 radio and television program presentations; wrote 79 news articles, and distributed 10,335 bulletins. Programs stressed the marketing of cattle through local livestock auctions, internal and external parasite controls, ram selections, wool marketing, culling of herds and poultry raising.

Although it is very difficult for the home demonstration agents to know accurately the number of women adopting practices due to the mass media methods employed, it is estimated that a minimum of about 7,500 Indian housewives were influenced to adopt new practices in home management, family economics, clothing, foods and nutrition, health, family life and safety.

On the youth side there were 91 Indian 4-H clubs with 569 boys and 873 girls active in 1957. Of this group 398 boys and 646 girls completed their project requirements.

ROADS

The 1957 Bureau road program was authorized in the Federal-Aid Highway Act of 1954. The act included an annual contract authorization of \$10 million for road construction and maintenance during the 1955, 1956, and 1957 fiscal years.

The \$2,300,000 maintenance part of the program provided routine maintenance on about 18,000 miles of reservation roads and bridges

in 23 States. The road maintenance program in the State of California continued special repair work due to the damage caused by the heavy floods in 1956.

The Bureau's road system was reduced by 415 miles in 1957 in line with the policy of constructing roads to an adequate standard under an agreement with the local government that it will then take the road into its system and be responsible for maintenance. An increase of 886.7 miles on the Navajo Reservation system is needed because the greatly increased Navajo educational program has created a need for more access and school bus roads to serve the many new school locations.

A total of \$7,700,000 was available for the 1957 road construction program. Chief accomplishments included 480 miles of grading and draining, 470 miles of gravel and bituminous surfacing, 941 feet of bridges, and survey and plan work for future projects.

CREDIT ACTIVITIES

Financing is required by the Indians to develop and utilize their resources, both physical and human. The Bureau's credit program is designed to help Indian people in meeting these needs.

Primary emphasis in the Bureau's credit operations is placed upon securing financing through customary channels. Secondary emphasis is placed upon financing by the United States, and by tribes and other Indian organizations.

Financing Through Same Credit Institutions Serving Other Citizens

The following is a summary of the estimated financing received by Indians from non-Bureau lenders during the past 4 calendar years:

Calendar year :

| | |
|-----------|----------------|
| 1953----- | \$27, 665, 000 |
| 1954----- | 33, 960, 000 |
| 1955----- | 55, 725, 000 |
| 1956----- | 59, 425, 000 |

The amount of outside financing for 1956 shows an overall increase of \$3,700,000 from the amount estimated to have been received in 1955.

Public Law 450 (approved March 29, 1956), which authorized the execution of mortgages and deeds of trust on individually owned Indian trust or restricted land, has been of assistance in enabling additional Indians to obtain justified financing from the same financial institutions serving other citizens. They are now in a position to utilize their chief asset, land, as security for loans. To indicate the

trend in this respect for the past 3 calendar years, the following is a summary of the totals, on a cumulative basis:

| Calendar year: | Number | Amount |
|----------------|--------|------------|
| 1954----- | 36 | \$143, 600 |
| 1955----- | 56 | 269, 900 |
| 1956----- | 86 | 475, 600 |

Financing Through Bureau of Indian Affairs

The main volume of financing for which the Bureau has responsibility is actually accomplished through tribes and other Indian organizations. Two main funds are involved, (1) tribal moneys, and (2) a revolving loan fund appropriated by the Congress. In addition to the active programs of the Bureau, two old credit programs are in process of liquidation, (1) so-called "reimbursable" loans which originated in (a) appropriations by the Congress during the years 1911-43, inclusive, for the purpose of encouraging industry and self-support among Indians, and (b) appropriations of funds held in trust in the Treasury for various Indian tribes for tribal industrial purposes, and (2) loans of livestock repayable "in kind".

The following shows the amounts involved in the Bureau's program at the close of the past 4 years:

| | 1953 | 1954 | 1955 | 1956 |
|--------------------------------------|--------------------------|--------------------------|--------------------------|----------------|
| Tribal funds----- | \$9, 704, 611 | \$9, 669, 468 | \$17, 300, 578 | \$21, 216, 542 |
| Revolving fund loans receivable----- | 10, 190, 941 | 9, 505, 193 | 8, 311, 374 | 7, 715, 612 |
| Reimbursable ¹ ----- | 988, 007 | 841, 568 | 498, 299 | 314, 040 |
| Livestock loans ² ----- | ² 1, 834, 415 | ² 1, 433, 575 | ² 1, 039, 445 | 715, 105 |
| Total----- | 22, 717, 974 | 21, 449, 804 | 27, 149, 696 | 29, 961, 299 |

¹ In process of liquidation.

² Figures differ from those previously published because of revaluation of livestock at estimated market value of \$35 per head in order that data may be comparable.

Use of Funds by Relending Organizations

Tribes and other Indian organizations use revolving funds borrowed from the United States and tribal funds to finance tribal business enterprises, to make loans to cooperative associations of members, and to make loans to individual members. At the close of 1956 nearly \$16 million had been loaned and invested in tribal business enterprises, nearly \$640,000 was outstanding in loans to cooperative associations, and nearly \$7,200,000 outstanding in loans to individuals. Indian organizations were carrying over \$6,600,000 in cash for operation of enterprises and for loans.

Balances outstanding at the close of the past four fiscal years were as follows:

| | 1953 | 1954 | 1955 | 1956 |
|-------------------|-------------|-------------|--------------|--------------|
| Enterprises..... | \$9,026,322 | \$8,913,728 | \$14,232,917 | \$15,949,360 |
| Individuals..... | 8,861,220 | 8,562,825 | 7,521,799 | 7,182,471 |
| Cooperatives..... | 149,974 | 136,650 | 161,177 | 639,375 |
| Total..... | 18,037,516 | 17,613,203 | 21,915,893 | 23,771,206 |

As of June 30, 1956, \$956,989 was delinquent on loans made to enterprises. Over 50 percent of the delinquent amount was on enterprises in Alaska. Four salmon canneries financed with loans through the Bureau have not, on the whole, been profitable. Special efforts have been made to place these enterprises on a sound operating basis during the past 2 years, and some improvement has been made as a result of corrective measures taken. The canneries had a deficiency of \$632,221 for the fiscal year ending March 31, 1954, which was reduced to \$495,466 for the fiscal year ending March 31, 1956. For the first time since the four canneries were acquired, all four recorded a profit for the fiscal year ending March 31, 1956.

Of the balance of \$639,375 unpaid on the loans to cooperatives at the close of the fiscal year, \$50,857 was delinquent or owing on loans in process of liquidation. Of this amount, \$44,386 is due on loans made by the United States many years ago, and will have to be charged off as uncollectible.

During 1956, a total of 1,160 cash loans totaling \$1,758,759 were made to individuals, compared with 1,008 loans of \$1,593,184 in 1955. The actual increase was greater than is indicated by these figures, since during 1955, three tribes for which readjustment legislation was enacted (Menominee, Klamath, and Ute) made 107 loans totaling \$184,060. These three tribes made no loans in 1956. Apart from these three, other tribes and organizations recorded an increase of 28.75 percent in the number of loans made, and 24.81 percent in the amount loaned to individuals, over the number and amounts loaned in 1955.

The repayment record on individual loans at the close of 1956 was in need of improvement. A total of \$1,885,895 of the unpaid balance of \$7,182,471 was either delinquent or owing on loans in process of liquidation, compared with \$1,481,358 at the close of 1955.

In addition to cash loans made to individuals, there was an estimated \$1,833,747 outstanding in loans made by Indian organizations repayable "in kind" at the close of 1956.

ARTS AND CRAFTS

The Indian Arts and Crafts Board has the responsibility of promoting the economic welfare of Indian people by educating the craftsmen in modern commercial methods, fostering high standards of quality and protecting both the consumer and producer from cheaply imitated wares.

Interest in Indian arts and crafts is increasing, not only among the public at large, but among the Indian people themselves as they realize more and more that this is an important part of their life and culture, and a significant source of livelihood. In many cases, income from arts and crafts sales is supplemental; in many others, it represents the only cash income received by the craftsmen.

The Board has continued to encourage the development of Indian owned and operated production-sales organizations through which the Indians are taught modern commercial methods without "commercializing" their products.

The several crafts groups in Alaska are continuing to make progress. Plans are now under way for further development and expansion with assistance from the Alaska Rural Development Board. A new project has come into being at Kivalina where Eskimo craftsmen are fashioning distinctive items of jewelry from caribou hoofs. These items have been on the market in limited quantity for the past several months. Sales have been excellent and there are plans to expand the project in fiscal 1958.

For the first time in several years, one of the regular quarterly meetings of the Board was held with the Seminoles in Florida. The Seminole Crafts Guild is a small but successful business enterprise. However, it was found there is still need for close supervision until the Seminoles are able to manage it for themselves. It is planned to put a full-time arts and crafts specialist on duty there.

The Qualla Arts and Crafts Mutual at Cherokee, N. C., has continued its successful operation. Membership in the organization is growing. The group is now beginning to think in terms of expansion and it is hoped that definite plans for enlargement will soon be developed.

The Oklahoma Arts and Crafts Cooperative at Anadarko is a new venture which started in 1956. While progress in fiscal 1957 was somewhat slow, the members are working hard to make the organization a success and are expected eventually to succeed.

At Rapid City, S. Dak., the Sioux Indians Exhibit and Craft Center is continuing to prove an effective instrument in serving the Indian citizens of the area as well as the community in general. In addition to the activities at the Center, the director continued to give

assistance to craft groups at Rosebud, Tama, Pipestone, and Cheyenne River.

The Board published a business booklet for Indian artists and craftsmen which has now been widely distributed. Comments received indicate that it is proving to be a worthwhile and useful publication.

PLANT DESIGN AND CONSTRUCTION

The Bureau's work in plant design and construction was substantially increased in fiscal 1957, requiring a reorganization of the staff and a material increase in the number of employees. This increase in work was brought about by several factors. The two most important factors were the accelerated educational program and a new policy in planning Bureau construction.

Plant design and construction work is tied in with the educational program on both a long-range and an immediate basis to provide school buildings, dormitories, kitchen-dining facilities, housing and other buildings required for educational purposes. While the funds provided for actual construction during fiscal 1957 were not unusual, this was the first year in which the Bureau received funds to do advance planning of projects to be financed from future appropriations. A total of \$539,600 was provided to make site surveys, prepare project requirements, and contract with private architect-engineers to design the required facilities and develop drawings and specifications for their construction. In accordance with the Bureau policy of contracting with private architects and engineers to design and prepare plans and specifications for all major projects requiring new plans, contracts were negotiated for and award made covering 9 projects at a cost of approximately \$92,230 for architect and engineer services. In addition, Bureau architects and engineers adapted plans and specifications previously used on similar structures so that they could be used on 16 projects which are estimated to cost \$1,808,000 for final construction. These advanced planning projects when complete will provide educational facilities for 185 children not now in school.

Construction was completed on 22 general contracts, with total contract and related costs of approximately \$2,381,232; and on two force account projects at a cost of approximately \$382,500. The completed work will provide additional facilities for 728 additional children, and improve health and sanitary facilities at 7 locations.

Work was in progress during the year on 37 projects estimated to cost approximately \$5,343,000. When complete, they will provide

educational facilities for 726 additional children and improve Bureau facilities at 29 locations.

PLANT MANAGEMENT

The Branch of Plant Management, newest of the Bureau's branches, was established under the Assistant Commissioner, Administration, by Commissioner's memorandum dated February 1, 1957, with responsibility for all functions comprising plant management including those formerly designated as maintenance of buildings and utilities.

Each area office was instructed to establish a similar unit under the Assistant Area Director for Administration.

In order to provide engineering guidance to the Bureau's programs in the field, a technical staff consisting of an electronics engineer and a mechanical engineer has been located in Albuquerque, N. Mex., where they will be available to assist all areas, including Alaska, on technical matters pertaining to communications and mechanical installations. Their primary functions, however, will be to analyze the operation, maintenance and plant management activities of the Bureau's installations, to promote the most effective methods of operation and maintenance, and establish adequate operating and maintenance standards throughout the Bureau.

PROPERTY AND SUPPLY

The Bureau's continuing study of its operations that may be in competition with private enterprise resulted in the closing of more laundries and bakeries in 1957. Services and products are now obtained commercially. Several bakery facilities will be operated as pastry shops for local requirements of certain schools in conjunction with, and as part of, the operation of the school kitchens.

In accordance with the act of May 20, 1948 (62 Stat. 248), certain land excess to the Sioux Sanitorium in South Dakota has been sold to various church organizations in Rapid City. In view of the interest of the Department and the Bureau of the Budget in the real property disposal program, the remaining land will be declared to the General Services Administration for disposition.

The declaration to General Services Administration of excess lands in other areas has been accelerated and the Bureau looks forward to even better progress in utilization of real and personal government property.

General Services Administration continues to establish motor pools throughout the country in certain large cities and surrounding areas. The Bureau is taking advantage of this program for acquiring its transportation needs wherever pools are available.

Employees' quarters have been revaluated and rates established in accordance with directives of the Bureau of the Budget.

During the year 444 cubic feet of records of the Central Office were transferred to the Federal Records Center at Alexandria, Va. This transfer released 245 square feet of floor space which was subsequently utilized for offices and personnel.

The time limitation on material which may be included in a Central Office file was recently reduced from 10 years to 5 years in order to facilitate the handling of files which have been transferred to the Center.

BUDGET AND FINANCE

Continued progress was made during 1957 in revising and improving the accounting system installed in Bureau accounting offices in fiscal year 1953 to better meet budgetary and program needs.

Studies are continuing to further improve, strengthen, and simplify budgetary and accounting requirements (including studies for further mechanization of the accounting work in the area offices) as well as to simplify the reporting requirements. Approval was granted the Portland area office to install an IBM accounting system beginning July 1, 1957. The machine accounting will be performed by the Bonneville Power Administration on a special reimbursable operation at an estimated cost of \$750 per month to the Bureau. It is estimated that this procedure will save approximately two man-years in the accounting section of the Portland area office.

Procedures were initiated to place trust individual funds in banks thereby currently obtaining greater interest yield for individual Indians than has been obtainable through Treasury bonds.

INTERNAL AUDIT

During 1957 Bureau auditors, working out of two audit field offices—one at Albuquerque, N. Mex., and one at Billings, Mont.—audited all of the Bureau's 10 areas and the Central Office. In addition four of the Bureau's 6 field relocation offices were audited and several special audit assignments were completed.

INSPECTION

The Bureau's inspection program was established early in March 1955. Since that time inspection personnel have spent a considerable amount of time in the field, visiting area offices and various other installations. Nine of the 10 area offices have been visited, some on more than one occasion, in connection with matters of inspection interest. Primarily the inspection office is responsible for the con-

duct of "incident-type" inspections, general inspection inquiries and team surveys. The objective of inspection is to promote and encourage high standards of conduct in the management of Indian Affairs throughout the Bureau's operations in line with announced Departmental policies.

MANAGEMENT COORDINATION

Organizational Changes

Only one significant organizational adjustment was effected in the Bureau in fiscal 1957. As reported above, a branch of Plant Management was created in the Division of Administration to provide specialized technical assistance in the operation, maintenance, repair and improvement of Bureau plant facilities. The new branch was created in response to the present and projected expansion of the Bureau's construction program for schools, dormitories, heating and power plants, water systems, and fixed equipment.

At the same time the Branch of Buildings and Utilities, located in Albuquerque, N. Mex., was redesignated the Branch of Plant Design and Construction.

Mechanized Procedures

The Bureau has moved forward energetically in its exploration of applications of punchcard procedures in several diverse fields.

The experimental enumeration of the Indians in the Aberdeen area has been completed, revealing information which has never before been available in quantity on such items as individual incomes, family status, occupations, and residences. Experience gained on this enumeration will be used in a census of the huge Navajo Reservation, to be undertaken in the near future.

Mechanized procedures also have been applied in almost all areas to account for nonexpendable property. By utilizing tabulating cards excess property becomes readily apparent, accounting is simplified, and better utilization of Government property may be achieved.

A pilot installation of mechanized financial accounting procedures is being conducted in the Portland area office and consideration will be given to bureauwide extension of the system. A selected number of tribal rolls have been converted to punchcards resulting in easier and more meaningful analysis of the information contained therein.

Reports and Forms Management Program

During the first year of operation 533 forms were reviewed under the forms management program, resulting in the elimination of

almost 50 percent and the revision of 22 percent of the remainder. Forms surviving this preliminary review are subject to further study when reordered.

Since the completion in July 1955 of the reports survey which was authorized by the 83d Congress under Public Law 663, the Bureau's reports management program has eliminated 35 percent of the reports inventoried under the survey. More than half of the 121 current reports are required by outside agencies, only 55 being used for Bureau purposes alone.

Report data, field study results, and data on population, land, budget, personnel, and programs have been gathered in a central unit. The results have been better and more accurate information, faster and more detailed answers to inquiries, and valuable management studies made possible by the readily available data.

Administrative Issuance Review

Moderate progress has been made in the review, revision, and coordination of CFR, published delegations of authority, Indian Affairs Manual and other administrative issuances.

New instructions governing the preparation and distribution of the Indian Affairs Manual were published. The new instructions prescribed a simplified format and numbering system and improved coordinative procedures.

Incentive Awards Program


Participation by Bureau employees in the incentive awards program increased markedly during the fiscal year. The number of suggestions for improving operations totaled a record 326—a 300-percent increase over fiscal 1956. Also, the quality of suggestions improved as the ratio of accepted suggestions to those received rose from 18 to 35 percent. The accepted suggestions represented an estimated \$22,221 savings to the Government.

PERSONNEL

A supervisory training program was initiated in 1957 for all supervisors at all levels. The contents of the program include training in human relations, related special subjects, organization interrelationships, and self-improvement. Sessions for supervisors are conducted each month at the various local, area, and Central Office locations. The junior internship program has been amended to include positions of a professional and technical nature at the entrance level. The broadening of this program affords more opportunity for all Bureau functions to take advantage of this type of training.

BUREAU OF LAND MANAGEMENT

Edward Woozley, *Director*



PUBLIC LANDS

THE BUREAU of Land Management was established as the Department's chief custodian of the public domain on July 16, 1946, when the General Land Office (established in 1812) was consolidated with the Grazing Service (created in 1934) under the provisions of the President's Reorganization Plan 3 of 1946.

The Bureau exclusively administers approximately 468 million acres of public domain lands, about 290 million acres of which are in Alaska. Most of this land is unappropriated and unreserved.

BLM also manages the mineral resources in about 58 million acres of lands now in private ownership, in which the Federal Government has retained the mineral rights, and many million acres of submerged lands in the Outer Continental Shelf.

In addition, the Bureau manages the mineral resources in another 242 million acres of federally owned lands whose principal management responsibility rests with other agencies, such as the administration of mining on the national forests of the Department of Agriculture.

Still another management responsibility of the Bureau of Land Management is what are known as acquired lands—some 58 million acres that come into federal ownership through purchase, exchange, transfer, condemnation, or donation.

Functionally, the Bureau of Land Management manages, conserves, and under a policy of development through wise use, manages the land and its natural resources, including the range grasses and other forage, the minerals (including oil and gas), and timber.

These activities fall principally into five categories—lands, minerals, range, forestry, and cadastral engineering.

Principal accomplishments for the fiscal year ending June 30, 1957, in these activities are summarized in the following pages.

LANDS

All lands activities of the Bureau of Land Management have been influenced by the increasing demands upon the Nation's public lands and their resources.

In the expanding economies of the public land States, new patterns of growth are being shaped by rapid population increases, industrial expansion, increased mobility afforded by superhighways, rising incomes, and more leisure time.

The small tract program in southern California is a dramatic example of changing patterns of land use. Desert hinterlands of Los Angeles and other urban centers, considered of marginal value except perhaps for limited grazing in recent years, are now being sought for rural homes or permanent residences. Prices recently paid for these lands have been as high as \$500 per acre.

To meet the demand for lands, the Bureau has found it necessary to institute every possible means to improve operations and program efficiency.

Lands Legislation

Several legislative matters of importance to land management programs have been under consideration by the 85th Congress. While these measures were not enacted into law by the end of the fiscal year, they had received favorable action from congressional committees.

One bill would provide that future applications for withdrawals or reservations of more than 5,000 acres for defense purposes would not become effective until approved by act of Congress, indicating the concern of the Congress over the multiple demands for public lands. The bill passed the House in the closing days of the 84th Congress, but was not acted upon by the Senate before adjournment. The Department has suspended action on applications for this type of withdrawal pending action on the similar bill which was introduced in the 85th Congress. The legislation has several features including safeguards to insure that minerals in reserved public lands remain subject to the public land mineral laws and that to the maximum extent surplus withdrawn and reserved lands are returned to the Department of the Interior for disposition under the public land laws.

Another important bill would grant Alaskan tidelands adjacent to surveyed townsites abutting tidewaters to the Territory. At present, permanent development cannot proceed on such lands owing to the fact that they are being held in trust for the future State of Alaska. Since many tidewater communities can expand only seaward, the Department has sponsored this legislation.



FIGURE 24.—O. and C. timber—Whether in selective cutting or clear cutting, sustained-yield management is the key to wise use of the timber resources of the vast forests and woodlands under the Bureau of Land Management's special jurisdiction.

Other Alaska legislation would permit the Territory to select lands covered by mineral leases in satisfaction of its grant of lands under the Alaska Mental Health Act. The Congress has under consideration additional land-grant legislation. Enactment of Public Law 507 (84th Congress) authorized the Bureau of Land Management to construct and maintain campsites and other recreation areas in Alaska, and to transfer them to the Territory for operation and maintenance. Amendment of this act to clarify its terms to make clear that it authorizes conveyance of title to improved recreation sites to the Territory has been proposed.

Indicative of the ever-growing problems of multiple use and intensive utilization of the public lands are the many legislative proposals which the Bureau had occasion to consider or comment upon during the year. These included the following subjects among others; the 640-acre limitation in the Recreation and Public Purposes Act; extension of the Recreation and Public Purposes Act to the O. and C. lands; creation of a wilderness preservation system; provision for the bulk sale of lands in Nevada to the Colorado River Commission of Nevada; recreational policy for public domain forest and woodlands; townsites in national forests, and for the other public land areas; and rights-of-way in national forests.

Regulations and Procedures

A corollary of the Bureau's continuing program to modernize the public land laws is the revision of the regulations. Regulations, issued by the Secretary, inform the general public of its opportunities, rights, and privileges under the public land laws. Operations of the Bureau are correlated with new legislation and regulations through issuance of policy statements and manual procedures. It is the responsibility of the Director's staff to provide these working tools to field officials.

The act of September 3, 1954 (68 Stat., 1146), provides the statutory authority for the Department to issue leases, permits, or easements to public agencies for the construction and maintenance of public works on lands it administers. During the year the Bureau drafted and the Department approved regulations to implement this act. Prior to enactment of this legislation, Federal land utilization programs were impeded by the lack of general authority to grant public agencies the tenure they often needed in Federal lands. The guarantee of tenure provided by Public Law 771 will permit capital investment in desirable public improvements on the public lands.

Other new regulations which have been issued pertain to veterans' rights and privileges (43 CFR 181), sales for public purposes and

rights-of-way in trustee townsites in Alaska (43 CFR 80), and applications for withdrawals and reservations (43 CFR 295). The latter places all withdrawal actions on the same basis, requiring an application for withdrawal in each instance, providing for segregation of the lands pending action on the application, and requiring publication of each application. The regulations stemmed chiefly from the increasing competition for public lands and the resulting need for procedures insuring full consideration of all the interests and problems involved. To this end, provisions are made for hearings when indicated and careful scrutiny of all applications by this Bureau with a directive to the Bureau for negotiations with applicants to keep all withdrawals to a minimum and to maximize multiple use.

Twenty-three releases for the lands volume of the Bureau of Land Management Manual were issued during the year. These ranged from minor revision of forms to complete procedures for handling various types of applications under the land laws. Procedures governing conduct of public sales of small tracts, procedures for the suspension of homestead (and desert land) entries under Public Law 834 (act of July 30, 1956, 70 Stat. 716), and samples of the proper form for public land orders were issued through Manual releases. Rules governing public relations in connection with field examinations were also issued in a Manual release.

Lands Adjudication

New applications received for the use or acquisition of public lands totalled 23,000 in fiscal year 1957, about the same quantity received in 1956, despite the fact that large areas were closed to small-tract filings. The number of unclosed cases as of June 30, 1957, was 51,700, as compared with 54,000 outstanding a year ago; a reduction of 4 percent.

Classification and Investigation

Land classification is the method by which the Bureau of Land Management seeks to attain its primary objective, which is to dispose of or develop vacant public lands for their highest use. In the continental United States, classification action under section 7 of the Taylor Grazing Act or under other statutory authority is essential before disposal of public lands may be allowed under the public land laws. In Alaska, authority to classify lands is limited to certain specific uses.

Application under the Small Tract Act was by far the most popular method used by the public seeking to acquire land for home,

business, or recreation sites. Almost 115,000 acres were classified for small tracts during the year as against a total of 24,132 acres in fiscal year 1956.

Since World War II, the rate of population growth has increased rapidly in the Western States, particularly in California, Nevada, and Arizona. Although this population growth has been concentrated primarily in urban areas, large tracts, some over 100 miles from major population centers, have assumed "suburban" aspects. Many factors have contributed to this situation. The Bureau has been making every effort to accommodate this demand, while at the same time insuring the proper classification and disposition of the lands, including proper tract layout and establishment of development standards where appropriate.

To facilitate the resolution of conflicts due to competing applications for lands, reduce the backlog of cases pending action, and promote the controlled use and disposition of public lands, a special program was placed in effect in southern California on March 14, 1957, with the approval of the Assistant Secretary of the Interior for Public Land Management. These procedures involved no special regulations. Under the program, preference was given to small tract disposition over competing prior filed applications for the same land under other public land laws, except for competing State exchanges and prior filed State selections. Emphasis was placed on sales without prior leasing, rather than leases with option to purchase, in areas where the county governments had provided adequate zoning and development standards. The closure of San Bernardino County, Calif., to filing of individual small tract applications on unclassified lands was a key part of the program.

In the State of Washington, approximately 150,000 acres have been classified as suitable for State lieu selections. For other lands that cannot be effectively managed by the Federal Government, regularly scheduled public sales of isolated tracts have been instituted.

Development of a Manual on a standardized land appraisal system has been a major goal of the Bureau's land classification program. Procedures have been established to implement recommendations of the Departmental Committee on Land Appraisal. Reviewing appraiser positions have been authorized for the area offices. Appraisal review boards have been established in the area, State and headquarters offices, and a roster of Bureau of Land Management appraisal personnel has been prepared. Key personnel attended appraisal short courses at educational institutions. The Bureau's Area 3 conducted an appraisal training course for all field examiners, and retained a private appraisal consultant to direct the instruction. Instructional material in the form of Manual releases has been issued.

Withdrawals and Restorations

Withdrawals of public lands in the United States and Alaska during the year aggregate 291,810 acres. Lands restored from withdrawals totaled 1,736,595 acres, or about six times the total area withdrawn.

The excess of lands restored over that withdrawn resulted in part from (1) the continuing request of Congress that action on all pending withdrawal applications by the Department of Defense for areas exceeding 5,000 acres be suspended, and (2) implementation of procedures for stringent and critical review of justifications for the withdrawal of lands for any purposes in the United States or Alaska.

Significant improvements in the processing of land withdrawals and restorations included (1) initiation of a field procedure for systematic review of all present withdrawals or reservation, (2) preparation of new regulations which will standardize application and processing of withdrawal requests, and (3) provision for an inventory of nondecentralized withdrawal applications and restoration requests pending in Washington or in field offices of the Bureau.

MINERALS

The Bureau of Land Management is charged with administering the various mineral leasing laws and United States mining laws which are designed to encourage the exploration and development of the necessary mineral resources to sustain the expanding national economy and contribute to the national defense.

The Bureau's mineral program is accomplished through (1) leasing of minerals on public domain lands, privately owned lands in which the mineral rights are reserved to the United States, and certain acquired lands; (2) the issuance of mineral patents and other instruments relating to mineral resource development; and (3) studies relative to mineral and other resource development and use.

General

In keeping with the established policy of multiple use and wise use without abuse, constant effort was directed toward expediting development of public domain mineral resources by opening new areas to mineral development and administering other areas in a manner that encourages development.

The Bureau is directly responsible for the administration and disposal of mineral resources under the mineral leasing laws and United States mining laws on the 468 million acres of mostly unreserved public land—about 178 million acres in the United States and 290 million acres in Alaska. It also has a participating responsibility in the management and disposal of mineral resources in another 242 million

acres of federally owned land reserved for various purposes, such as national forests, irrigation projects, power sites, military and atomic energy use and other public purposes.

Accomplishments

The volume of mineral activities on all of the above-mentioned types of lands continued at a high level throughout fiscal year 1957 except for the Outer Continental Shelf. No new OCS competitive lease sales were made during the year.

The Bureau's total earnings from royalties, rentals (including OCS), and bonuses from competitive oil and gas and other mineral leasing reached an all-time high of \$83,396,659 as compared to \$71,302,743 in fiscal year 1956.

These earnings were achieved through a program of wise multiple use designed to meet the ever-increasing need for our natural resources through intelligent, long-range management that will insure the protection and conservation of all our resources.

Regulations, Procedures, and Orders

During the past fiscal year numerous regulations and procedures were amended or written to expand the Bureau's program of opening new areas to mining and leasing.

Coal and phosphate regulations were amended to allow acceptance of relinquishments of leases, upon a satisfactory showing that the public interest will not be impaired, even though the lessee is subject to a remaining liability under the lease. Formerly thousands of acres of lands involved in lengthy litigation were tied up indefinitely.

An amendment to the Code of Federal Regulations (issued as Circular 1977) removed the 60-day waiting period formerly required for noting partial relinquishments on noncompetitive oil and gas leases on tract and plat books, thus making the lands available for further leasing as soon as they are noted on the tract and plat books.

Asphalt deposits in approximately 400,000 acres of former Choctaw and Chickasaw lands in Oklahoma are now available for leasing under new regulations issued January 12 (Circular 1968). These lands were acquired by the United States from the Choctaw-Chickasaw Nation of Indians by the act of May 24, 1949 (63 Stat. 76-84).

Lands in military reservations, reservoir areas, and other Government lands, not subject to mining location under the United States mining laws, are now available for uranium prospecting by permit, and mining under a Government lease. BLM will receive and process applications and the Atomic Energy Commission will approve and issue permits and leases.

An agreement has been reached with the Federal Farm Mortgage Corporation on procedures for leasing lands transferred to the Bureau of Land Management by Public Law 760. Some 6,500 tracts of land scattered throughout the United States have been transferred to the Department and some 12,000 other tracts will be transferred on September 6. Upon completion of a study of title records, regulations and procedures will be issued providing for the leasing of these lands.

Public Land Order 1400 issued March 29, 1957, opened 4,160 acres of land to potassium leasing. Approximately 1,840 acres of this land is scheduled to be leased on July 31.

Approximately 581,564 acres of land in Petroleum Reserve No. 7 of July 2, 1910, were opened to general mining location by Public Land Order No. 1403, dated April 2, 1957. Lands within this reserve had been open to leasing and to metalliferous mineral location, but prior to the issuance of Public Land Order No. 1403, they were closed to general mining location.

These substantial public land areas now opened to leasing exemplify the Department's and the Bureau's efforts to assure maximum beneficial returns from public lands through multiple use under effective conservation safeguards.

A new oil and gas acreage control system is being installed in the field offices to aid in administering the acreage limitation provision of the mineral leasing law.

Legislation

Final regulations under Public Law 167, the Multiple Use Act, were issued as Circular 1961 on September 28. This law provides the Government with authority to manage the surface resources on unpatented mining claims subject to the act and also removed "common varieties" of minerals from under the mining laws and placed them under the Materials Act.

Approximately 1,000,000 acres have been examined to date and publications ordered on about 900,000 acres. In addition, publication has been ordered on 10 million acres of Forest Service lands. Current operations indicate that "unlocking" of vast timber resources will benefit both industry and the Nation as a whole.

Under the administration of Public Law 357, which provides for the entry and location on discovery of a valuable source material on public lands classified or known to be valuable for coal, 2,913 claims were recorded as of June 1, 1957. This law permits a greater utilization of our natural resources in North and South Dakota and adjacent areas. Further progress in this area requires the development of an

economical method of extracting uranium from coal. This problem is currently receiving the diligent attention and efforts of both Government and industry scientists.

Since the passage of the Multiple Use Mining Law in 1955 (Public Law 585), there has been a large increase in mining activities, particularly in uranium. This law also opened areas to oil and gas leasing that had formerly been covered exclusively by mining claims, and, conversely, opened some 60 million acres to mining location that had been previously closed due to the existence of oil and gas leases.

The administration of Public Law 359, which opened over 7 million acres of withdrawn power site lands to mineral development, has resulted in 8,116 filings covering approximately 169,276 acres.

Adjudication of Mineral Cases

On June 30, 1957, there were outstanding approximately 108,018 oil and gas leases on public domain covering 80,254,466 acres, including the Outer Continental Shelf. There were also 4,499 outstanding oil and gas leases on acquired lands of the United States covering 3,937,189 acres. A total of 2,350 permits, leases, and licenses for other minerals covering 3,435,320 acres were likewise in effect on public domain and acquired lands.

During fiscal year 1957, new and reactivated noncompetitive oil and gas lease offers and applications for lease totaled 62,121 and a total of 60,646 were closed during that period. Approximately 25,687 oil and gas lease assignments were handled during the period. During that same period the new and reactivated mineral patent applications amounted to 194 and 316 cases were closed during the year. In addition, there were 3,928 miscellaneous applications in connection with mineral locations and 5,483 of such cases were closed. In all, 92,132 cases were closed as against 90,509 received, reducing the backlog of cases pending from 24,387 to 22,764.

Table No. 1 shows the number of mineral cases adjudicated in the continental United States and Alaska during fiscal year 1957.

The chief source of revenue to the United States from the use and disposal of resources in the public lands is from leases issued under the mineral leasing acts. The revenues for fiscal year 1957 resulting from royalties, rentals, and filing fees under the mineral leasing acts, was \$81,901,988 compared to \$69,890,971 in fiscal year 1956. In addition to this, a major source of receipts is also derived from bonuses offered for the issuance of oil and gas leases. A summary of bonuses received from such competitive mineral leasing by States is shown in Table No. 2.

TABLE 1.—*Adjudication of minerals cases, Bureau of Land Management, fiscal year 1957*

| Type of case | Cases pending July 1, 1956 | New and reopened cases | Cases closed | Cases pending July 1, 1957 |
|-------------------------------------|----------------------------|------------------------|--------------|----------------------------|
| Public domain lands: | | | | |
| Oil and gas leases: | | | | |
| Noncompetitive..... | 10,962 | 59,593 | 57,727 | 12,828 |
| Competitive..... | 1,133 | 257 | 1,316 | 74 |
| Mineral leases..... | 318 | 324 | 403 | 239 |
| Mineral permits..... | 1,514 | 1,456 | 1,383 | 1,587 |
| Mineral patent applications..... | 654 | 194 | 316 | 532 |
| Other mineral locations..... | 20 | 239 | 209 | 50 |
| Acquired lands: | | | | |
| Oil and gas leases: | | | | |
| Noncompetitive..... | 2,635 | 2,728 | 2,919 | 2,444 |
| Competitive..... | | 2 | 2 | |
| Mineral leases..... | 678 | 77 | 518 | 237 |
| Mineral permits..... | 1,391 | 593 | 871 | 1,113 |
| Public domain and acquired lands: | | | | |
| Oil and gas assignments..... | 5,017 | 24,266 | 25,687 | 3,596 |
| Resource sales..... | 26 | 75 | 68 | 33 |
| Outer Continental Shelf leases..... | 39 | 705 | 713 | 31 |
| Total..... | 24,387 | 90,509 | 92,132 | 22,764 |

TABLE 2.—*Areas leased and bonuses received, competitive mineral leases, Bureau of Land Management, fiscal year 1957*

| Type of mineral and State | Public domain lands | | Acquired lands | | Total | |
|---------------------------|---------------------|----------------|----------------|----------------|--------------|----------------|
| | Acres leased | Bonus received | Acres leased | Bonus received | Acres leased | Bonus received |
| Oil and gas: | | | | | | |
| Colorado..... | 2,557 | \$20,315 | | | 2,557 | \$20,315 |
| Montana..... | 15,893 | 110,564 | | | 15,893 | 110,564 |
| New Mexico..... | 2,441 | 243,680 | | | 2,441 | 243,680 |
| North Dakota..... | 80 | 301 | | | 80 | 301 |
| Ohio..... | | | 68 | \$2,658 | 68 | 2,658 |
| Oregon..... | 124,295 | 55,691 | 26,490 | 9,671 | 150,785 | 65,362 |
| Utah..... | 80 | 200 | | | 80 | 200 |
| Texas..... | | | 538 | 278,755 | 538 | 278,755 |
| Wyoming..... | 9,791 | 475,570 | | | 9,791 | 475,570 |
| Total oil and gas..... | 155,137 | 906,321 | 27,096 | 291,084 | 182,233 | 1,197,405 |
| Coal: | | | | | | |
| Colorado..... | | 280 | | | | 280 |
| Illinois..... | | | 130 | 233 | 130 | 233 |
| Montana..... | 960 | 960 | | | 960 | 960 |
| North Dakota..... | 40 | 40 | | | 40 | 40 |
| Utah..... | 2,383 | 2,384 | | | 2,383 | 2,384 |
| Wyoming..... | 480 | 2,400 | | | 480 | 2,400 |
| Total coal..... | 3,863 | 6,064 | 130 | 233 | 3,993 | 6,297 |
| Other minerals: | | | | | | |
| Phosphate: | | | | | | |
| Idaho..... | 4,368 | 285,398 | | | 4,368 | 285,398 |
| Wyoming..... | 640 | 160 | | | 640 | 160 |
| Sodium: | | | | | | |
| Wyoming..... | 5,132 | 5,390 | | | 5,132 | 5,390 |
| Sand stone: | | | | | | |
| Missouri..... | | | 10 | 10 | 10 | 10 |
| Uranium: | | | | | | |
| Arizona..... | 520 | 10 | | | 520 | 10 |
| Total other minerals..... | 10,660 | 290,958 | 10 | 10 | 10,670 | 290,968 |
| Grand total..... | 169,660 | 1,203,343 | 27,236 | 291,327 | 196,896 | 1,494,670 |

RANGE MANAGEMENT

Severe drouth conditions throughout many of the western range areas dominated the progress of range management programs during the past fiscal year. In the Southwest, continuous drouth since 1950 has left ranges and the range livestock industry in a critical state. The situation attracted national attention and resulted in a tour of the affected areas by the President and the Secretaries of Agriculture and Interior. The economic impact of the drouth on range livestock operators was reflected in requests for general waiver of grazing fees, and in many individual requests for remission of fees. Subsequently, the Secretary upon the recommendation of the Bureau postponed the changeover to a sliding scale grazing fee formula for 1 year, until January 1958. If the new formula had been affected, grazing fees would have advanced approximately 2 cents per animal unit month.

Although the drouth was general, local areas in northern Nevada, southern Idaho, and southeastern Oregon were favored with above average moisture in 1956. Abundant rainfall continued in these areas into 1957, and late winter snows in the Great Plains region, plus general spring rains, produced one of the best range forage crops in 20 years.

In Wyoming, Colorado, Utah, southern Nevada and Arizona, improved moisture conditions lessened the local effects of the drouth. Large areas of public rangeland in California and New Mexico were still plagued with drouth at the close of the fiscal year.

Early in the year range personnel were devoting considerable effort to relieving disastrous drouth conditions. Later in the year the lush forage growth, which had not been used, resulted in a high fire hazard and considerable effort was directed at suppressing range fires. In spite of these unscheduled events, good progress was made toward the accomplishment of planned objectives for the year.

Grazing Administration

A small increase in the grazing administration staff to provide for mineral activity under Public Law 167 relieved regular range personnel of this work, permitting more effort to be devoted to grazing functions. Continued emphasis on early completion of the adjudication of grazing privileges and related activities in gathering and analyzing basic data has resulted.

Analysis of the areas of responsibility of field offices led to the establishment of a new district office at Casper, Wyo., during the year. This office is unique in that it marks the first time that an area con-



FIGURE 25.—The Bureau of Land Management practices "multiple use" where opportunities for range and forest utilization, watershed protection, soil and moisture conservation, mining and mineral operations, and wildlife and recreation needs exist in the same area of public land.

sisting entirely of grazing lands administered under section 15 of the Taylor Grazing Act has been set aside for administration by a separate field office. It was necessary in this case to provide better supervision and control of the range as well as the development of a conservation program for over 2 million acres of Federal grazing land.

Significant strides were made in the control of grazing trespass on the public lands, which still continues as a persistent and difficult range problem. Control procedures must be further improved before trespass can be brought to an irreducible minimum. Progress has been made in the development of guidelines for the assessment of trespass damage of adequate reliability to be admissible as evidence in court actions.

Progress in completing the adjudication of grazing privileges is closely geared to range forage inventory surveys. These surveys are basic to reliable determinations of range grazing capacity and an equitable apportionment of grazing privileges among qualified users. Bureau policy on range surveys provides for constant striving to improve survey methods in order to improve their acceptability by

both the range users and the public. Positive steps have been taken to implement this policy by the Bureau in assuming leadership among the Federal agencies having similar range responsibilities, for conducting a joint study of survey methods looking to improved techniques and uniform standards.

In addition to giving added emphasis to range and soil resource inventory of western range lands, the Bureau has participated in a cooperative survey of Kodiak Island, Alaska, with the Alaska Experiment Station and Soil Conservation Service. This is consistent with the efforts of the Department to aid in development of the small scale livestock industry which now exists in the Territory.

Proceeding under a policy of adjudicating the most difficult problem areas first, several key areas were handled in 1957. The present backlog of 102 appeal cases pending before the hearing examiner is less than it was 1 year ago. During the 1957 fiscal year, 68 new appeals were filed, while the examiner processed 83 cases. Processing of appeals to the Director has been expedited by placing an adjudicator on the range staff.

Wildlife Management and Recreation

Along with grazing by domestic livestock, wildlife and recreation are the most extensive uses made of the public grazing lands. Increasing big game populations are intensifying some local management problems. Bureau field offices are participating in an increasing number of wildlife studies in which the utilization of range forage by wildlife and livestock is being determined. These will provide basic information for herd adjustments and improved management practices.

Cooperation with State game departments on water development and reseeding projects is increasing, benefiting both wildlife and domestic livestock. The Bureau is participating in a proposed inventory of browse revegetation work, past and future, which will culminate in a general report of all agency activities in this field. The objective of this joint effort is to improve the range for wildlife and livestock.

Camping, hiking, and other forms of recreation have been increasing from year to year. The largest recreational use is associated with hunting of big game, and upland game birds and fishing. The total use can only be estimated by the annual kills of big game, usually estimated by the State fish and game departments. Wildlife management will always be a major factor in administration of public lands in the Territory of Alaska. The problem dealing with grazing of

bear and livestock on Kodiak Island has resulted in certain amendments to the boundaries of the Kodiak National Wildlife refuge being proposed to the Department by the United States Fish and Wildlife Service and the Bureau. In addition, an agreement for management of reindeer in Alaska has been developed with the United States Fish and Wildlife Service and the Bureau of Indian Affairs and approved by the Department.

Range Studies

The gradual expansion of range condition and trend studies, which received new emphasis 3 years ago, has now attained an important status in the management of public rangeland. Additional range study transects to be used as a yardstick in measuring long-time changes in the condition of the range, are being established with each passing year. Semi-intensive methods for determining range condition have now been employed to cover a major portion of the range area. The cumulative effects of several years drouth has added to the significance of condition and trend studies. Reports for calendar year 1956 show a slight increase in the number of acres classified as "on a downward trend" due, no doubt, to the effects of drouth.

About 75 percent of the total range area is now classified in fair-to-excellent condition. The Bureau's program of condition and trend studies has been augmented by those conducted in cooperation with other agencies such as State fish and game departments.

Range utilization checks, largely abandoned during World War II, have been reactivated. A significant portion of every grazing district is being covered each year. These checks go hand in hand with the condition and trend studies and give an annual measure of the quantity of forage used by livestock.

Studies conducted in cooperation with western land grant colleges and Federal research agencies are in progress on several range management problems. Of most importance are those concerned with controlled pasture use from which actual use data will be obtained for application to the Federal range.

The Bureau's research program at the Squaw Butte Experiment Station in southeastern Oregon was transferred to the Agricultural Research Service of the United States Department of Agriculture. That agency is continuing the studies in cooperation with Oregon State College. This transfer was made in order to consolidate the work being carried on at the station with similar work being done by the Agricultural Research Service.

Change in Status of Public Grazing Lands

The Bureau has cooperated extensively with the United States Forest Service in working toward a transfer of certain land utilization project lands which are suitable for administration in conjunction with grazing districts, from the Forest Service to the Bureau of Land Management.

Numerous contacts with local groups and agencies were made, and three public hearings were held in Montana to obtain a full expression of the desire of local residents on the matter. Final action on the transfer is now pending.

Soil and Moisture Conservation

The second year of the Department's 20-year program for conservation treatment of Interior lands has produced very beneficial results. Recent watershed planning has been directed toward acquiring better coordination between conservation activities and grazing management. To adequately safeguard conservation projects it is necessary that proper grazing use of range vegetation be established. Definite efforts have been made recently to complete essential management adjustments prior to the installation of conservation practices.

Prominent among projects placed on the range are reseeding, retention and detention dams, contour furrowing, protection fencing, and water developments. In particular, emphasis has been given to the latter two in connection with management programs in order to acquire better control of grazing use. Along with many of the detention dams, waterspreading dikes are also installed that have proven very effective on some range areas by greatly increasing the vegetative cover.

Two additional practices that have recently become prominent are brush eradication and soil pitting. Thousands of acres of juniper have been eradicated, by means of chaining or dozing, particularly in the Southwest. The eradication of sagebrush has also been completed on many areas by means of railing, chaining, chemical spraying (usually by airplane), mulching with a brush cutter, or plowing. Several of these practices are frequently followed or accompanied by seeding the area to perennial grasses.

A series of research studies on erosion, runoff, and sedimentation are being conducted with various agencies in the Southwest and particularly in Arizona. The Geological Survey is collecting hydrological data to be used in watershed planning and the Agricultural Research Service in completing evaluation studies on the efficiency of detention dams in trapping silt. Water yield studies are being

conducted on the San Simon Wash in Arizona by the Geological Survey to determine the effect of structural treatments on annual runoff to the Gila River.

Range Improvement

The range improvement fund has been largely devoted to the maintenance of existing range improvement. Part of it has also been used for construction of new facilities, such as livestock water developments and allotment boundary fences. Livestock watering reservoirs, spring developments, and wells are constructed not only for the benefit of livestock, but also for obtaining better distribution of livestock on the range and elimination of unnecessary movement of livestock for great distances between watering places. Fencing of ranges is needed for livestock control in order to assure more even utilization and the proper season and intensity of use of forage plants. In this effort substantial contribution from range users is received for maintenance of projects. Grazing permittees are required to maintain a majority of improvements placed upon their use areas. Many range improvements are constructed entirely with the funds and facilities of range users. These are authorized under provisions of sections 4 and 15 of the Taylor Grazing Act. The use of section 4 permits varies in different States and districts, depending upon local conditions.

Weed Control

For the past 6 years the Bureau has operated a program for the control of halogeton, a poisonous range weed. Although concerted efforts have been made to control halogeton; it continues to spread and infect additional range areas each year. An estimated 11.5 million acres are now affected, of which 8.4 million acres are administered by BLM and the remaining 3.1 million acres are private, State, or other Federal lands. Each year the Bureau makes surveys of large areas to locate any newly infected areas. During fiscal year 1957, approximately 10 million acres in the Western States were surveyed.

Considerable progress has been made in reducing the livestock poisoning effects of this plant. While a great many sheep are still poisoned each year in the more heavily infected areas, these losses have not been widespread. Livestockmen have become acquainted with the plant and with effective methods of handling livestock to avoid losses. The control program of the Bureau has significantly influenced the effect of this plant on livestock using the range, as well as on the range itself.

The main direct attempt to control halogeton has been chemical spraying. During the past year nearly 28,000 acres of land have been sprayed with a low volatile ester of 2,4-D. This chemical treatment has been effective in reducing the rate of spread of the plant by preventing seed development. Generally the former program of spraying large extensive areas has been replaced with operations covering only scattered spots and the edges of general infestations usually along rights-of-way and other avenues of spread. Good cooperation has been received by the Bureau in the halogeton control program. Range users have made contributions in cash, materials, or labor. The Bureau of Reclamation has reimbursed BLM for treating certain areas under its jurisdiction. Likewise, State departments of agriculture, railroad companies, weed control districts, and other agencies and organizations have been helpful on many areas in control operations. The Bureau has cooperated with research organizations to increase the fund of knowledge concerning the nature and habits of halogeton and effective means of control. The Bureau has entered into research agreements with the Agricultural Research Service and



FIGURE 26.—The development of water on arid ranges is an important part of the range improvement program conducted by the Bureau of Land Management, under authority of the Taylor Grazing Act. This structure, in Colorado, is typical of those which make possible most advantageous seasonal use of the Federal range.

the Agricultural Experiment Stations of the States of Idaho, Nevada, Utah, and Wyoming. Under this cooperative endeavor many findings important in managing halogeton infested ranges have been made.

FORESTRY

The Bureau of Land Management has exclusive jurisdiction over approximately 161 million acres of forest lands in the United States and Alaska. These lands are protected from fire, insects, disease, and other hazards; they are managed for compatible multiple uses under the principle of sustained yield and improved through rehabilitation and reforestation of nonproductive areas.

During the past fiscal year concentrated efforts were made to develop a better balanced program through expansion of inventory, rehabilitation and reforestation, timber trespass, program planning, recreation, improved administrative procedures, and closer coordination with other Federal agencies and related activities. Enthusiastic cooperation and assistance of Bureau personnel, industry, local communities, and other public agencies have contributed to the substantial progress made in each of these activities.

Nature and Scope of BLM Forestry

The 161 million acres of forest land administered by the Bureau of Land Management includes more than 2 million acres of the so-called O. and C. lands contained in an 18,000-square-mile checkerboard in western Oregon, 34 million acres of public domain lands scattered throughout the Western States (plus some limited acreages in certain of the Eastern States), and an estimated 125 million acres of public domain in Alaska. Of this amount approximately 6,125,000 acres in the United States and about 40 million acres in Alaska are classified as "commercial" forest lands; lands which support timber of a size, quality, and quantity suitable for economic production of sawtimber under currently prevailing conditions. The remaining 30 million acres in the United States and 85 million acres in Alaska support timber suitable for production of mine props, ties, posts, fuel wood, and limited sawtimber and are classified as "woodlands." As other available supplies of timber decline and as technological and economic conditions change it is likely that much of the "woodlands" may be reclassified as "commercial" forest lands.

The aggregate volume of BLM "commercial" forest lands is estimated to be 260 billion board feet. The estimated volume on the woodlands totals 212.5 billion board-feet. The current annual pro-

ductive capacity of all BLM forest lands is conservatively estimated as 3.4 billion board-feet. The timber and related resources on the Bureau's vast timberlands represent one of the Nation's most valuable natural resources. They are one of the assurances of the continued well being of the Nation and its people.

The nature of BLM forest lands, their location and the diversity of their products and uses are such that different types of forest management programs must be devised. Programs now in effect may be considered to be of three major types:

1. Intensive sustained yield management for the production of sawtimber and for the other purposes, as illustrated by the O. and C. lands of western Oregon.

2. Similar but less intensive sustained yield management taking into account disposals under applicable public land laws and those circumstances peculiar to the timber, lands and uses involved. The program for the public domain forest lands in the United States is representative of this type.

3. Extensive forest management dominated by very acute fire protection problems and involving vast, undeveloped areas. The program for the public domain forest lands in Alaska is an example of this type.

Comprehensive, detailed forest management programs and plans are essential for orderly, businesslike administration of BLM forestry activities. During fiscal year 1957 major revisions were made in BLM forestry (and other functional activities) programing techniques. The resulting material provides a means not heretofore available, for developing balanced, integrated, multiple resource programs for BLM forest lands. Such programs show estimated total jobs, by major activity, to be done and that portion of the total job to be carried out during the current and next 2 succeeding years, along with estimated requirements to do these jobs in terms of manpower, materiel and money. These data also provide a useful base to evaluate the effectiveness of current and previous expenditures of manpower, materiel and money.

Detailed "forest management atlases" were put into wide use throughout the O. and C. area during the past fiscal year. These "atlases" provide a means for maintaining a detailed, up-to-date status of current and proposed forestry activities for given geographic units. They have already proven to be a useful tool for more efficient management of the O. and C. and CBWR grant lands. Other public and private forest management agencies have requested that copies of this material be made available for their own use.

Forest Inventory

Accurate, up-to-date inventory of the forest resource is a prerequisite of a sound forest management program.

Continued progress was made on inventory of timber on the O. and C. and CBWR grant lands in western Oregon. This very intensive inventory is expected to be completed during 1960. As a result of new inventory data the annual allowable cut for these lands was increased on October 26, 1956, by 46.6 million board-feet to a total of 660.7 million board-feet. Inventory now in progress is expected to raise these cuts still higher.

During the past fiscal year new techniques were developed to provide even better inventory data. This technique involves use of permanent sample-plots and compilation of data on tabulating machine cards. This procedure, recently placed into practice, will provide greater efficiency, economy and accuracy in the continuous timber inventory process.

Comprehensive plans for detailed inventory of public domain forest lands in the Western States were developed during the past fiscal year, and extensive areas were inventoried in California, Oregon, Idaho, Utah, Nevada, Arizona, Montana, Colorado and New Mexico. An extensive inventory, through use of chartered aircraft, was completed for public domain forest lands in Wyoming.

A comprehensive plan for inventory of the forest resources in Alaska, including special techniques and procedures, was developed jointly with the Forest Service. Active inventory projects, based on these plans and techniques are now being carried out in Alaska.

A forest inventory Manual release which outlined policies and broad guidelines was prepared and issued to field offices to assist these offices in developing uniform, standard inventory practices.

Access to BLM Forest Lands

The scattered nature of much of BLM forest lands, heavy demands for forest products and related resources make access to BLM timber one of the most acute management problems. Progress of the past fiscal year has probably been the most significant and far reaching of any single previous year. Prominent items include a comprehensive 6-year plan for access roads on the O. and C. lands, a Manual release for the O. and C. right-of-way regulations, roads records system, policies for coordinating road construction between public agencies and other matters.

The 6-year road plan includes a program with estimated construction costs totaling \$68.5 million for approximately 800 miles of mainline access roads.

Plans were developed and appropriations were obtained for the first time for acquisition of rights-of-way and roads necessary for public domain timber sales in Oregon and Colorado. This will provide a long needed "tool" for the rapidly expanding public domain timber sales program.

A Manual release covering O. and C. right-of-way regulations was prepared and issued to field offices. In the brief period during which it has been in effect this manual has greatly simplified many aspects of the O. and C. right-of-way processing.

A detailed road records system for O. and C. timber access roads was developed and placed into effect. The technique outlined therein will permit expeditious uniform processing of road use charges and road amortizations not heretofore possible.

To date, \$22,350,000 have been appropriated for construction or acquisition of O. and C. access roads and 165 miles of mainline access roads and 15 bridges have been built or are now under construction.

Timber Sales

The various activities which make up the timber sales process continued to absorb a major portion of BLM forestry efforts. During fiscal year 1957, 781 million board-feet of timber valued at \$21,264,021.58 were sold from Bureau forest lands. Receipts to the United States Treasury from BLM forestry activities during this past fiscal year totaled \$21,471,604.26.

Timber from the O. and C. and CBWR grant lands accounted for 628,682,000 board-feet of this amount. Public domain and other types of timber sales made up the remainder.

A comprehensive review and analysis of existing regulations applicable to the sale of BLM timber was completed during fiscal year 1957.

New and improved regulations and contract forms for the sale of O. and C. and CBWR timber were developed during the past fiscal year. A Manual release, supplementing these regulations, has been drafted and will be issued shortly after the regulations are made effective.

A revised and improved technique for cruising and appraising western pines was developed and placed into effect.

On April 1, 1957, after public hearings and evaluation of all pertinent data, marketing restrictions for timber cut from O. and C. and Coos Bay Wagon Road grant lands were revoked. The marketing restrictions, imposed following public hearings in 1946 and 1947, provided that timber cut from O. and C. or CBWR grant lands must receive primary processing within the marketing area in which it

was harvested. Technological advances, changes in the lumber industry, and in local and national economies had made these restrictions obsolete. More complete and more profitable utilization of BLM timber can be expected as a result of revoking the marketing restrictions.

A recent policy statement providing for coordinating the O. and C. annual timber sale plan with annual sale plans of nearby national forests should prove most helpful to the timber industry, other public agencies, and the public.

Rehabilitation and Reforestation

Another prerequisite for sustained yield forest management is adequate provisions for regeneration of commercial species on cut-over, burned, or otherwise denuded lands.

Continuing demands for forest products, dwindling supplies of readily available timber, high stumpage prices and very productive lands make it good business for the BLM to program for rapid reforestation of denuded lands. During the past fiscal year 3,809 acres of cutover O. and C. lands were planted with nursery-grown trees. Since 1951, 23,820 acres of O. and C. lands have been planted with such trees. An additional 827 acres were seeded during fiscal year 1957. This amount, together with areas previously seeded, totals more than 9,575 acres. The areas reforested by seeding or planting since 1951 total 33,398 acres.

During the past fiscal year detailed plans were made for increasing the area of O. and C. lands reforested annually by planting or seeding approximately 35,000 acres. This greatly expanded program will be placed into effect in fiscal year 1958.

A continuing, large-scale reforestation program will assure future supplies of forest products and, through reducing the period usually required for restoring forest lands to full production, increase the average annual yield of timber on the O. and C. lands.

Timber Trespass

Unauthorized cutting and removal of timber from BLM forest lands has been a growing menace to the Bureau's forest management program. This exceedingly complex problem is further complicated by the many different State civil and criminal statutes which are applicable to timber trespass. Some States have no applicable statutes, civil or criminal, under which a timber trespasser may be prosecuted. In such States, effective control of timber trespass on BLM forest lands is even more difficult than in the States which have applicable but inadequate statutes.

During the past fiscal year BLM forestry personnel in California, with the assistance of Federal law enforcement agencies and local courts, have succeeded in obtaining a conviction under criminal statutes, of a party who knowingly cut and removed timber from BLM forest land. This is the first such conviction in the judicial history of that State. A significant and far-reaching precedent has been established as a direct result of actions undertaken by BLM forest personnel. It is likely that this conviction, more than any other single factor, will probably pave the way for eventual control of trespass on BLM forest lands and thereby materially reduce annual losses estimated at \$1 million as a result of such trespass. Another direct result of this conviction is the recent enactment of a timber trespass statute by the State Legislature of California. This statute will provide another long-needed tool for control of timber trespass on BLM forest lands in that State.

Recreational Use of BLM Forest Lands

The outstanding esthetic and recreational potential of many of the O. and C. and CBWR grant lands and much of the public domain in Alaska have been recognized for many years. During fiscal year 1957, through the combined efforts of BLM and National Park Service personnel, a comprehensive survey of the needs for development of this vast recreational potential was undertaken. The survey included field examination of possible sites, development of standards, specifications and estimated costs for equipment and facilities for camp grounds, picnic areas and other recreation areas, and recommended program projects. It is expected that initial action on the higher priority projects will be undertaken during fiscal year 1958. A number of recreational sites of various types were developed pursuant to Public Law 507 during the past fiscal year on BLM forest lands in Alaska. It is expected that these sites will help to reduce the number of man caused fires in addition to serving other purposes.

The public enjoyment and benefits from use of these recreational areas, while difficult to measure in monetary terms, are nevertheless substantial.

Organization and Administration

During the past fiscal year comprehensive, detailed organizational surveys were made of a number of BLM forestry field offices, including those in the O. and C. area in California and Alaska. As a result of these surveys more decentralization of BLM Forestry activities is being undertaken through establishing additional field offices in some areas and by realignment of staff duties and responsibilities in others.

Numerous other recommendations to improve efficiency and service have been or are being placed into effect as a result of these surveys.

Fire Protection

Adequate protection of the timber and related resources on BLM forest lands from fire, insects, diseases, and other hazards is another prerequisite to good conservation and a sound resource management program.

In Alaska the Bureau maintains its own fire detection, prevention and control organization. Valuable assistance and cooperation are provided by the Territorial, military and private agencies, and individuals. In the United States the major portion of fire protection efforts are through contracts with the Forest Service, State and private fire protection agencies.

During fiscal year 1957 continued progress was made in establishing radio communication facilities in various field offices in the Western States. Plans were prepared for installation of new radio communications systems in Alaska. Modest additions were made to existing supplies of tools and fire suppression equipment in many of the field stations.

An interim fire danger rating index, developed with the cooperation and assistance of the Fire Research Division of the Forest Service, was placed into effect in Alaska. This index will enable BLM personnel to better evaluate the various hazards which might promote uncontrolled forest fires.

Extensive use was made of aircraft for patrol during periods of high fire danger in Alaska and certain Western States.

Plans were made for the inauguration of "smokejumping" in Alaska. This technique will be adopted when adequate facilities have been constructed. "Smokejumping" will enable BLM fire fighters to get to fires before they become uncontrollable. The vast majority of fires in Alaska are not accessible by road and an effective air arm is an essential item in the control of forest fires.

Helicopters and charter aircraft were used extensively to ferry fire fighters and material to and from fires in Alaska. The helicopters proved to be particularly effective in otherwise inaccessible areas.

Contract protection for about 6.5 million acres of BLM forest lands in the United States was continued.

During the past fiscal year a Manual release covering policies and guidelines for determining the amount of damages to timber and related resources as a result of fires was prepared.

Efforts to control insect infestations in BLM forest lands were expanded during fiscal year 1957. A limited area in north central California was treated to control pine bark beetles, and approxi-

mately 87,560 acres in Montana were treated to control a spruce budworm infestation discovered in 1956.

Disease control measures were directed against white pine blister rust on a limited area of BLM forest lands in southern Oregon.

Training

The Bureau of Land Management currently employs a permanent staff of about 310 professional foresters, and approximately 100 non-professional or seasonal personnel (including clerical and stenographic), to carry out its many forestry activities. Because of the complex and highly diversified nature of the Bureau's forestry program extensive on-the-job and other types of training are required.

During the past fiscal year numerous training sessions for forestry personnel were held by various offices or in cooperation with forestry schools or other public or private agencies. Such sessions included special group training in timber cruising and appraising, road location and construction, forest inventory, rehabilitation and reforestation, fire detection and suppression, program planning, timber sales and timber trespass. On-the-job training for these and other activities are carried out on a continuing basis. These "investments" in training pay off in better and more efficient performance throughout the employees' service with the Bureau.

CADASTRAL SURVEYS

The Bureau of Land Management is the official Federal agency for conducting the public land surveys in the United States and Alaska. These surveys establish and identify the boundaries of the public lands and divide the lands into areas conforming to the rectangular survey system. Land boundaries must be known before a comprehensive land management program can be initiated, including the development and conservation of the natural resources. The survey work of the Bureau is limited by law to the survey of the public lands under its jurisdiction. Surveys conducted for other Federal agencies are done on a reimbursable basis. The law also permits private contributions to defray the cost of cadastral surveys on the public lands.

Most of the public lands in the continental United States are located in the 11 Western States. In those States there are more than 100 million acres of public lands over which the cadastral survey "net" has not yet been extended. In addition, over 50 million acres of public lands are in need of resurvey to restore lost or obliterated markers and to correct earlier surveys made before the development of modern precise survey equipment and methods.

The 1957 Program

The cadastral surveying program of the Bureau of Land Management for fiscal year 1957 was designed primarily to aid, to the fullest extent, in the management of lands and the development and conservation of the natural resources; to lay out homesites for the Nation's increasing population; and to mark out on the ground the boundaries of lands granted to the States for benefit of their schools.

Surveys in the forest areas in Oregon and California were made to define the boundaries between private and Federal lands for settlement of trespass and for the determination of the boundaries of sales units.

Of major importance, especially to some of the Western States, has been the survey of school sections. The sections must be surveyed before the States can secure title to them. The vast increase in the development of the resources existing on the public lands has created a demand by the States for the survey of their school sections. The determination and location by cadastral survey of the boundaries of Federal range lands is also an important part of the program.

The subdivision into units of five acres or less to meet the demand for homesites and the resurvey of areas for oil and gas leasing and exploration, where the original survey monuments have been obliterated, was another major part of the program. In Alaska, surveys were made primarily for homesites and settlement purposes and for oil and gas leasing.

Work has continued on the preparation of leasing maps on the Outer Continental Shelf. These maps provide descriptions and area of the off-shore lands being leased for oil and gas. Due to recent technological improvements in drilling operations the oil and gas leasing maps on the Outer Continental Shelf off the coast of Louisiana have been extended to include areas extending seaward from the coastline to the limits of the shelf—reaching depths of up to 600 feet.

Experiments have been made in the use of helicopters to transport survey crews and equipment to work areas in rough, remote, and mountainous areas in southern Utah where it is almost impossible to complete that work by ground methods. The results of these tests demonstrated a 20-percent reduction in the cost-per-mile of survey work, while at the same time the output of the crews was more than doubled. In the future, helicopters will be used as an aid in making cadastral surveys in rough mountainous areas. The Bureau is also studying the feasibility of using precise aerial photographic equipment and methods in survey work.

Surveys in Continental United States

Cadastral survey projects completed during fiscal year 1957 consisted of the survey and resurvey of 1,418,431 acres of public lands. The surveys included the identification of the sections granted to the States for the benefit of their schools; the survey and resurvey of mineral lands as an aid in the development of those resources, primarily oil and gas; the resurvey of forest areas to define the boundaries of timber management units for the settlement of trespass cases and to provide a basis for timber sales; the survey of grazing lands; and the survey of small tracts to provide home and business sites.

Other projects were carried on by the Bureau for other Federal agencies to facilitate their land management activities and the development and conservation of the natural resources. This type of work included extensive resurveys for the Bureau of Reclamation in the Missouri River Basin and on the Trinity River project in California; resurveys for the National Forest in California and Arizona; resurvey of Indian lands in New Mexico; resurveys in Colorado for the Bureau of Standards to define and mark the boundaries of their lands; and the resurvey for the Department of the Army of the boundaries of the Hunter-Liggett Military Reservation in California. The program also included other surveys and investigations, such as the survey of islands and omitted land areas. Numerous maps and diagrams were prepared for the Department of Justice in connection with pending litigation involving certain Indian claims.

The survey of school sections made 128,880 acres available to the States of Arizona, California, and Utah. Although there are large areas of unsurveyed lands remaining in all the Western States, the need for completing the original surveys in order that the States may obtain title to the school lands exists primarily in those three States. In general, the program was based on the desires of the States to cover the areas of greatest value and interest.

In the other Western States the unsurveyed areas are located principally in permanent reservations such as national forests, parks and monuments, and Indian reservations. In these areas, indemnity selections have been made by the States for a large portion of the designated unsurveyed school sections in the reservations and school lands in those States, to a large extent, have been satisfied.

Alaska Surveys

The field program for Alaska was designed to meet the needs for the management of the public lands; the development and conservation of the natural resources; and to accommodate the expanding economy of the Territory and its increasing population.

During the fiscal year several urgent Alaskan projects were undertaken. One accomplishment was the survey and resurvey of 35,840 acres of land under the rectangular system of surveys. In addition, survey was made on 1,172 small tracts; 2 homesteads; 36 homesites; 12 trade and manufacturing sites; 2 headquarters sites; 1 Alaska public sale tract; 4 recreational sites; 242 townlots in one townsite; and 7 miscellaneous surveys.

OUTER CONTINENTAL SHELF

The Outer Continental Shelf Office at New Orleans is administered by the Eastern States Office of the Bureau of Land Management. During 1957, the office acted on an increasing number of applications for rights-of-way for pipelines and took several important actions resulting from the United States-Louisiana operating agreements of October 12, 1956. In addition, assignments, relinquishments, and other actions on approximately 500 oil and gas and sulphur leases were performed.

Two hundred and sixty-four leases were validated for the Louisiana State Mineral Board, and over 300 section 6 leases were extended.

Close contact was maintained with oil and gas lease sales by the Gulf States, and where areas to be leased by the States were in conflict with the OCS areas administered by Interior, appropriate notices of protests were directed to the States concerned.

There were no new OCS lease sales during the fiscal year due to the boundary dispute with Louisiana now before the Supreme Court, in which the other Gulf Coast States may join, and also because there were other uncertainties such as the large area in the Gulf requested by the Navy in which oil and gas and sulphur leasing and drilling would be restricted.

As of June 30, 1957, there were 495 OCS section 6 and 8 oil and gas leases and 5 sulphur leases covering 1,711,170 acres from which a total of \$305,542,733 has been collected to date. Of this amount, \$107,141,429, the total collections up to June 30, 1957, from the area in dispute, have been placed in escrow pending decision of the Supreme Court on the issue involved in *United States v. Louisiana*.

EASTERN STATES

The Eastern States Office in carrying out its 1957 program in the southern States of Alabama, Arkansas, Florida, Louisiana, and Mississippi, and in the Lake States of Michigan, Minnesota, and Wisconsin transferred title on 84,423 acres of public lands to non-Federal ownership largely by area and public sales to individuals. This comprised 800 tracts, including small tract auctions. In the above

acreage was 18,000 acres of State selections and exchanges, 1,500 acres transferred to two States under the Recreation and Public Purposes Act, and 4,600 acres to qualified individuals under the Color of Title Act. Receipts from sales amounted to about \$700,000, of which \$300,000 was for 25¼ million board-feet of timber that went with the land.

The Russellville, Ark., office completed about two-thirds of its sales program in the southern States leaving approximately 44,000 acres of public lands in those States. This should be largely sold or otherwise transferred by early 1959, with the bulk of the remaining public lands in the States of Alabama, Louisiana, and Mississippi mostly under color of title or some other form of conflicting claim.

The Lake States program, with the fieldwork under the local office at Bemidji, Minn., has progressed to where disposals in Michigan and Wisconsin are nearly finished with only 7,000 acres remaining in these two States, and most of that now in pending exchanges with the Forest Service, United States Department of Agriculture, and the States concerned.

A management program including timber and large-scale Christmas tree sales now in progress in Minnesota which has approximately 100,000 acres of vacant public lands. About two-thirds of this is in tracts too large to sell or transfer under the public land laws, or is in withdrawals that should be retained for public purposes and recreational uses. Most of the smaller scattered tracts will be offered at public sale in the next year.

APPEALS

As the result of a comprehensive management study, a special unit was established in April 1955 in the Division of Technical Programs to more effectively and expeditiously handle cases on appeal to the Director of the Bureau of Land Management.

Formerly, cases had been processed by the various program staffs. Establishment of the Appeals Office has made possible the separation of appeals work from staff operations, thereby providing centralized and unified control on appeals actions. The processing of appeals work is now located in a single organizational unit which is responsible for such actions from the time the appeal is first received until formal disposition of the case.

Coincidental duties of the appeals staff include the maintenance of appropriate legal, reference, and statistical data and the distribution of such information throughout the Bureau.

When the Appeals Office was established in 1955, there was a backlog of nearly 1,200 lands and minerals cases on appeal. That backlog has been substantially reduced.

In the 2 years of its existence the Appeals Office has disposed of over 3,600 appeals cases through formal decisions. In addition a total of 3,368 miscellaneous memoranda and letters have been prepared during the 2-year period. The prompt and efficient handling of appeals actions and eventual elimination of the appeals backlog will substantially improve the Bureau's operations and its services to the public.

Two major management innovations have been initiated by the Appeals Office. In order to facilitate adjudication operations in the Bureau's field offices, all decisions prepared by the Appeals Office are duplicated for distribution to the field. In addition, the Appeals Office has prepared and issued a digest-index of appeals decisions that is made available to all adjudication personnel of the Bureau. As the result of the significant contributions which this office has made to the Bureau's public service function, the Appeals Office was awarded a unit citation for meritorious service covering the first 2 years of its operations.

INTERNATIONAL COOPERATION

Facilities and officials of the Bureau of Land Management were utilized as requested by the International Cooperation Administration and other specialized agencies on foreign programs within the fields of the Bureau's primary technical competence. All requests were met for technicians for overseas assignments, Bureau facilities and officials to assist foreign technicians working in the United States, technical backstopping of international activities, and technical advice and support of United States positions for international conferences.

The Bureau's long experience with fundamental resource development problems on the public domain is being carried to essentially every free world country. There is a constant exchange of ideas with technicians of other countries. Increasing activities in the large number of underdeveloped countries are emphasizing the necessity of improving basic land policies and practices to meet the needs of expanded resource development. These are the countries which have the extensive productive land areas and undeveloped resources for future land settlement and raw material requirements of the free world.

While the land and resources of the underdeveloped countries

ordinarily have only started to reach their development potentials, results of land management activities particularly adaptable to these countries are encouraging.

STAFF SERVICES

The function of the Division of Staff Services is to provide necessary service in various fields to all of the functions and operations throughout the Bureau, both in Washington and in the field. The Division of Staff Services is under the supervision of the Associate Director. Three principal offices operate within this division to carry out the majority of the continuing functions charged to the Division of Staff Services. These three offices are: (1) the Office of Hearings Administration, (2) the Management Improvement Office, and (3) the Program Coordination Office.

Office of Hearings Administration

During the year, measures to facilitate the orderly and timely disposition of proceedings before the Bureau in which formal hearings are required, were carried forward. Such hearings provide the basis for adjudication of various types of claims, entries, and proceedings arising under Federal laws and departmental regulations, relating to the use and disposition of public lands and their resources.

On May 1, 1956, the Department rules of practice for the conduct at hearings were revised. As a major change and improvement, land office managers were relieved of the responsibility for performing hearing functions.

In October 1956, the Department's rules of practice were further revised to incorporate all provisions of the Administrative Procedure Act (5 U. S. C. 1001 et seq.) relating to adjudication based upon hearings, including the utilization of hearing examiners, qualified and appointed under regulations of the Civil Service Commission.

By the close of the year, eight hearing examiners, each with specialized experience in the Bureau's work, had been appointed and were actively engaged in hearing cases and rendering decisions on them. The examiners are headquartered at points within the 11 Western States where most of the cases requiring hearings arise.

A summary of the Bureau's hearings activity during the year appears in the following table. More than half of the fiscal year had elapsed before several of the hearings examiners had been appointed, and their offices placed in operation. This explains, in large measure,

the slight increase in unclosed cases between the beginning and end of the fiscal year.

Total number of hearings, Bureau of Land Management, fiscal year 1957

| | <i>Number of hearings</i> |
|---|-------------------------------|
| Unclosed cases before hearings officers at beginning of year----- | 228 |
| Referred to hearings officers during the year----- | 229 |
| Heard during the year----- | 149 |
| Closed during the year----- | 217 |
| By decision following hearings----- | 123 |
| By action not involving a hearing----- | 94 |
| Unclosed cases before hearings officers at close of year----- | 240 |

Office of Management Improvement

The Management Improvement Office administers management improvement, incentive awards, records management, forms management, docket control, organization and method studies, regulations and manual releases, and special management studies in the Bureau.

Washington and the four area offices scheduled and worked on a combined total of 103 management improvement projects during the year. These included both major, bureauwide projects and several of local scope. In addition, each of the State offices, and the districts within each State, conducted active programs on management improvement projects pertaining to operations under their respective jurisdiction. In 1957, Washington and area offices scheduled 43 management improvement projects considered to be of major importance. State, land and district offices are participating in this program with many projects pertaining to their local operations.

Increased workload in incentive awards activity during fiscal 1947 necessitated some decentralization of operations, by delegating certain award authority to each of the four area field offices.

Special management studies of major significance undertaken during 1957 included: a study of the Sacramento, Calif., forest district office; studies of the management of the O. and C. land, and of the five district offices established in Oregon to manage these lands; an organization and methods study of the Utah Land Office; and a comprehensive study of the reorganization plans for Bureau operations in Alaska.

Office of Program Coordination

The Program Coordination Office provides a system for the recordation of future program proposals by all activities of the Bureau, and an orderly method for communicating these proposals from the originating field office to the Washington Office for review, approval

or revision. Horizontal coordination among various technical and administrative staff functions within any supervisory level of the organization is also fostered by this program. The program technique and system provides the primary source for the development of the Bureau's budget prior to submission to the President.

Greatest advances made in operation of this office during the fiscal year 1957 were in the program planning system. A program planning conference was held in Denver, Colo., at the beginning of the fiscal year (July 1956) for the purpose of obtaining the cooperation and viewpoints of personnel working at different levels in the various activities which the Bureau operates and to design a workable system and medium for uniform planning of future operations in each of these activities. The conference was composed of several committees which were each responsible for designing program planning systems and forms to be used. The committees collectively resolved a system which, when put into effect in the fall of 1956 for use in developing the 1959 program proved highly satisfactory.

A second conference, held at San Francisco, Calif., in April and May of 1957 to refine and revise the system designed in Denver was very successful. The results have been published and distributed to the field for use in preparing the proposed fiscal year 1960 program and its accompanying budget. Preliminary review and revision of a program progress reporting system to be initiated in the near future was also accomplished at this conference.

The system now in use, and the medium provided for program planning, provides for a uniform submission of program proposals.

The use of programs founded on the judgment of those directly responsible for their execution in developing a budget request, and the spending appropriations based upon these requests, helps to insure: (1) more realistic development of resources and lands under the jurisdiction of the Bureau; (2) more equitable treatment of "first problems first;" (3) better service to the public.

Records Improvement Project

The project received an initial allotment of \$575,000 at the outset of the year, and subsequent allocations to bring the total to \$682,000. These funds were expended on three major projects. Two of these were contracts, one for \$242,500, and one for \$229,500 for reconstruction of the Utah and New Mexico land records. The third project involved purchase of auxiliary equipment incident to the use of the new records system, such as insulated tabulating card filing cabinets and microfilm readers for distribution to the land offices. New map-filing cabinets, binders, and shelving units, especially designed

for the new records, were procured for installation in the land offices at Salt Lake City and Santa Fe.

Plans for the fiscal year 1958 include advertising for bid to reconstruct the records of Oklahoma during the early part of the year, and, if funds permit, for another contract to reconstruct the records of another State.

STAFFING

The Bureau continued its emphasis on comprehensive training to provide for maximum utilization of employees skills. Approximately 80 formal training sessions have been conducted on a Bureau, area, and statewide basis. Special attention was given to the development of professional forestry and range personnel. Under an agreement with the Civil Service Commission, forestry and range personnel at the GS-5 and GS-7 grade levels are given intensive training over a 6-month period to furnish them with a variety of progressively responsible experience to accelerate their development. This intensive training not only furnished a definite means of better utilization of technical skills and improved development of career employees in shortage categories, but also provides greater incentive through increased opportunity for more rapid advancement. In addition to the formal training program for forestry and range personnel, a special training program was conducted for potential land office managers. Participants in the program were selected on the basis of their demonstrated ability in the field of management. Four management trainees, representing three of the four areas and the Washington office, participated in the Department's eighth management training program in Washington.

The current shortage of engineering, range and forestry personnel was met by an intensive recruitment program. Brochures describing the Bureau's work program were prepared and distributed to major colleges. In addition, Bureau personnel visited the colleges for the purpose of interviewing students and describing career opportunities in the Bureau. Significant results were achieved in the recruitment of foresters by means of an agreement between the Department of the Interior and the Civil Service Commission. Under the terms of the agreement, the Bureau was authorized to conduct Civil Service examinations in the colleges and to offer appointments to qualified students.

Employment in the Bureau as of June 30, 1957, totaled 2,856, distributed as follows: Area 1, 817; Area 2, 764; Area 3, 733; Area 4, 222; Eastern States Office, 52; and Director's Office, 268.

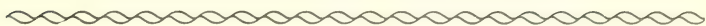
FINANCE

Receipts from the management of public lands in fiscal year 1957 amounted to \$112,059,358. This amount included \$2,208,703 from rents and royalties on the Outer Continental Shelf and \$109,850,654 from public-land receipts. This is a decrease of \$100,157,164 below the prior fiscal year as no leases on the Outer Continental Shelf lands were issued. As a result, revenue was placed in escrow pending final decision on the boundary of the Outer Continental Shelf lands. The receipts of \$109,850,654 from public lands were an all-time high, the previous high being \$100,992,667 in fiscal year 1956. Of the total amount, \$38,700,056 was distributed to States and counties. The receipts were from varied sources, principally from oil and gas leasing, timber and land sales, and permits and leases.

Obligations incurred for operations during fiscal year 1957 amounted to \$23,776,153.

THE NATIONAL PARK SERVICE

Conrad L. Wirth, *Director*



NINETEEN FIFTY-SEVEN will go down in the history of the National Park Service and the National Park System as a notable year principally because it saw the actual launching of Mission 66. It was a gratifying year in that it gave the Service its great opportunity to put park conservation into practice in a manner and on a scale befitting the character of the National Park System. It was a challenging year in its demand that this opportunity be met wisely and economically.

Many other events helped to make the year an unusual one. One of these was the establishment of the 29th national park—Virgin Islands—through the far-seeing generosity of the family of Mr. John D. Rockefeller, Jr. Another was the completion of the Colonial Parkway and of new visitor centers at Jamestown and Yorktown, in Colonial National Historical Park, Va., in time to serve the thousands of visitors to the Jamestown-Williamsburg-Yorktown Celebration. The charm and beauty of the parkway and the effectiveness of the visitor centers have occasioned much favorable comment, as has the glassmaking plant established and operated at Jamestown by the Jamestown Glasshouse Foundation.

The results of 2 years of painstaking study of the Atlantic and Gulf coasts saw expression, early in the year, in the publication of a popular version of the official report, entitled "Our Vanishing Shoreline." This handsome, well-illustrated brochure was given wide and effective distribution and has made large numbers of Americans aware of the loss they face unless effective steps are taken, and quickly, to preserve some of the remaining sections of still unspoiled shoreline against the invasion of commercial resorts and private home construction. The anonymous donor of the funds which paid the cost of the study and the issuance of the brochure was so pleased with the widely favorable response to it that he provided additional funds with which to conduct similar studies, now well under way, of the shores of the Pacific Coast and the Great Lakes.

There is great satisfaction in the realization that the National Park System continued to be the object of such acts of generosity as those listed. To them should be added: The donation of \$400,000 by Jackson Hole Preserve, Inc., to match a similar amount of appropriated funds for land purchases; an anonymous donation to permit the Service to acquire greatly needed additional lands for the Wright Brothers Memorial at Kitty Hawk, N. C.; and an additional donation of \$200,000 from the Avalon and Old Dominion Foundations for the purchase of Cape Hatteras National Seashore lands.

Mission 66

The Service is eager to carry forward the Mission 66 program as rapidly as the Congress provides the funds for it, but it is equally eager that every element of it be the result of sound, basic planning and of functionally sound design. Though the year brought funds for a greatly expanded program of construction of buildings and utilities, and though progress was made difficult by the scarcity of personnel in the design professions, the accomplishment in design, contracting, and construction was one of which the Service has every reason to feel proud.

The public attitude toward Mission 66 continues to be almost universally favorable. The major exception is in western Washington, where newspapers, chambers of commerce, and the Automobile Club of Washington have been highly critical of the Service's program for Mount Rainier National Park. This program proposes the ultimate elimination of overnight accommodations from the high altitude and deep winter snows of Paradise Valley and the compensating provision of accommodations at lower elevations, for which feasible sites were designated after careful study of all possibilities. It proposes also the removal of park headquarters facilities, so far as that is feasible, from a dangerous and limited area at Longmire to a site to be selected near Ashford, outside the park. This plan would make more space available at Longmire for picnicking and camping; it would, it is believed, also permit such long term economies in operation as to justify it from that standpoint.

Opponents of the elimination of overnight accommodations at Paradise hope that the Government, which bought out the existing and outmoded facilities of the Rainier National Park Co. several years ago, will replace them with others of more modern type. It is generally agreed that private capital considers such an investment too great a risk for it to undertake.

Late in the year the Service also announced the principal features of its program for Yosemite National Park. One proposal of major



FIGURE 27.—Construction work on the Stevens Canyon Road at Backbone Ridge with spectacular Mount Rainier in the background. Started in 1931, grading was nearly completed when work was suspended on account of World War II, and was not resumed until 1949. Under the National Park Service Mission 66 program, this \$4,784,000 highway was completed late this summer (1957).

importance looks to the removal of many park operations from the floor of Yosemite Valley to a new administrative site at El Portal, just outside the Arch Rock entrance, thus relieving the valley of certain activities which can be carried on as well elsewhere, and of many structures, most of which are old and obsolescent, or worse.

Concessioner Developments

With funds available to the Service to bring in utilities, and to construct needed access roads, parking areas, and paths, provision of additional concession facilities have been materially stepped up in a dozen areas. Most notable among these was the opening of the new Canyon Village in Yellowstone with 500 guestrooms, lodge, stores, and campgrounds, and completion of some 89 new cabins at Colter Bay, in Grand Teton, as well as appurtenant facilities. A new lodge was opened in Yosemite and extensive cabin developments are under way at Grand Canyon, Shenandoah, Everglades, Glacier, Lassen, and Virgin Islands National Parks.

Training Center

A milestone in the Service's effort to supply effective training to its employees was passed when the Congress approved the proposal to establish a training center for career-conditional uniformed employees at Yosemite National Park on a 3-year trial basis. Both staff increases as Mission 66 progresses, and earlier retirements because of liberalized retirement legislation, make it vitally necessary that new park rangers, historians, naturalists, and archeologists, early in their careers, become soundly grounded in Service history, policies, and practices. Each year, some 50 men and women, attending 3-month training periods, may be expected to find their niches in the organization much more rapidly and surely than has been possible in the past.

Advisory Board

Two members of great distinction were appointed to the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments upon the expiration of the terms of Maj. Gen. Ulysses S. Grant, III, and Dean Turpin C. Bannister of the College of Architecture and Fine Arts of the University of Florida. They were Dr. John Allen Krout, vice president and provost of Columbia University, and Earl Howell Reed, Chicago architect. Dr. Krout, teacher and writer of history, and Mr. Reed are expected to contribute greatly to the solution of problems involved in the preservation of historic sites and

buildings, an important Mission 66 objective. Throughout their terms on the Board, both General Grant and Dr. Bannister contributed valuably to its deliberations.

Florida Problems

Final action had not been taken, by the end of the fiscal year, on legislation solidly backed by Florida's Senators and Representatives, to establish final boundaries for Everglades National Park. While this legislation would eliminate certain lands from the northeastern part of the park, it would add others of great importance in the Ten Thousand Islands area, and provide a fully protected water corridor from the northwest. An earlier decision not to permit construction of overnight accommodations at Flamingo, on Florida Bay, was modified because of the conviction that they were needed so that park visitors might gain full enjoyment of the park, especially on boat trips requiring a very early morning start.

A troubling problem, for which the Service is seeking a satisfactory alternative, is posed by a proposal to use some of the already limited lands of Castillo de San Marcos National Monument as right-of-way for a widened State highway.

Dedication of Virgin Islands National Park

The 84th Congress, near the close of its 1956 session, authorized the establishment of Virgin Islands National Park, to include the major portion of St. John Island, as the 29th national park, subject to Federal ownership of not less than 5,000 acres of land within its ultimate boundaries. Deeds for slightly more than that acreage having been tendered by Laurance F. Rockefeller, in behalf of Jackson Hole Preserve, Inc., of which he is president, the newest national park was dedicated with appropriate ceremonies at Cruz Bay, on St. John Island, on December 1, 1956. Speakers included Mr. Rockefeller, Secretary of the Interior Fred A. Seaton, and Governor Walter A. Gordon of the Virgin Islands. The Director of the National Park Service was master of ceremonies. Guests at the dedication ceremony included the Governor and other Territorial officials, a number of residents of the Islands, and special guests—including numerous newspaper and magazine representatives—brought from the mainland by Jackson Hole Preserve.

Harold A. Hubler, until then superintendent of San Juan National Historic Site, was appointed the first superintendent of the new park, but also retains jurisdiction over the historic site.



FIGURE 28.—Left to right, Conrad L. Wirth, Director of National Parks; Fred A. Seaton, Secretary of the Interior, and Laurance S. Rockefeller at the newly dedicated Virgin Islands National Park, December 1, 1956. This 29th national park was made possible by the generosity and foresight of Mr. Rockefeller who acquired, and presented to the Government, the major portion of the Island of St. John.

Interpretation

The visitor center "idea," to provide one or more focal points for information and interpretation in most of the areas of the system which need them, has proved itself, if one may judge from the immediate public response to those opened during the year at Jamestown, Yorktown, and Grand Canyon. Though such facilities offer perhaps the most noticeable advance in meeting the interpretive task, all phases of interpretation, self-guidance, the use of audio-visual materials, more and better literature, roadside signs, markers, and exhibits, and the preparation of museum exhibits—have made excellent progress.

It is particularly gratifying to record that the University of North Carolina Press is to publish "Interpreting Our Heritage," the book by Freeman Tilden, which records the results of his 2 years of study of interpretive methods and practices, undertaken with anonymously donated funds.

Legislative History

When long-time Superintendent Edmund Rogers left Yellowstone last autumn, he started giving full time to completion of an exhaustive legislative history of all the areas of the National Park System, a project which had been a part-time and valuable hobby of his for many years. It is expected that it will take 2 years to finish the necessary research and to put the large amount of material in shape for use.

Motion Pictures

Two motion pictures of exceptional quality dealing with national parks appeared during the past year. "National Parks, Nature's Last Frontier," produced by Martin Bovey, is to be distributed by Minneapolis-Moline; it deals perceptively with the National Park System as a whole. "Yosemite, Valley of Light," is the title of a film produced by the Ford Motor Co., and is perhaps as fine a pictorial treatment as has ever been made of a single park.

"The People's Heritage," produced 2 years ago by the Craven Film Corp., with photography by John H. Storer, deals with the beauty and inspiration of the national parks and some of the problems they face. With anonymously donated funds, this film has been updated and "tied in" with Mission 66 and 50 copies were obtained for use in connection with the interpretive work of the Service.

Catastrophe

Grand Canyon National Park was the scene of the worst commercial airline disaster on record on June 30, 1956, when United and TWA airliners carrying 128 persons collided and crashed in the isolated eastern end of the Canyon, with the loss of all on board. Immediately following the discovery of the wreckage, the park staff became involved in one of the most difficult rescue and recovery operations in its history. Air Force and Army provided helicopters and required personnel, while Superintendent McLaughlin and his staff furnished advice and guidance in reaching the crash sites. For nearly 2 weeks park personnel were busy assisting in recovery operations and working with newspaper and magazine people from all over the world who came to cover the story.

The area where the wreckage lies is still closed to the public.

General Grant Tree Becomes National Shrine

Some 4,000 persons were present when the General Grant Tree, in Kings Canyon National Park, which has long been known as the Nation's Christmas Tree, was dedicated as a national shrine, pursuant to an act of Congress. Adm. Chester Nimitz, retired, representing President Eisenhower, was the principal speaker. The American Legion of Sanger, Calif., and the Service jointly sponsored the ceremony.

Bryce Canyon and Zion Administration Separated

Nearly 28 years after its establishment as a national park, Bryce Canyon became a separate administrative unit on July 1, 1956. Previously, it had been administered jointly with Zion National Park.

Winter Use

Winter visitation in the eight national parks which offer limited facilities for snow sports continues to increase, with 411,851 last winter as compared with 361,760 the previous winter. Some 40 percent of visitors participate in skiing, skating, and sliding; the others come to enjoy the winter scene, so completely different in appearance from that viewed by those who come in other seasons. An interpretive program inaugurated at Hidden Valley, in Rocky Mountain National Park, was well received. Improved and expanded interpretive exhibits and information services were provided generally in these winter-use parks.

Mountain Climbing

The summit of Longs Peak, in Rocky Mountain National Park, was reached last summer by 1,596 persons; it is the most popular climb in the National Park System. At Grand Teton National Park, 1,644 climbers made successful ascents, 477 climbing Grand Teton. Mount Rainier—boasting a revised elevation of 14,410 feet, up 2 feet—was ascended by 406 persons. In its 50th anniversary year as a national monument, Devils Tower had the heaviest climbing season in its history, with 123 individuals attaining its summit.

Only one fatality directly associated with mountain climbing occurred in the National Park System.

River Running

Trips by boat down the rivers of Dinosaur National Monument have now given several thousand people, of all ages, an opportunity to view its magnificent canyons from water level; 762 visitors made boat trips there last year. Regular boat trips down the Snake River from Moran to Moose in Grand Teton National Park, started last summer, attracted 900 patrons, and probably 300 others made the trip in private boats.

While the Colorado, on its course through Grand Canyon National Park and Monument and Lake Mead National Recreation Area, does not attract so many river runners, the number of boat trips from Lees Ferry to near Boulder City continues to increase.

Special Observances

President Theodore Roosevelt first made use of the authority granted him by the Act for the Protection of American Antiquities to establish national monuments by proclamation to give that status to Devils Tower in Wyoming. The 50th anniversary of his action—August 24, 1956—was observed at Devils Tower with appropriate ceremonies at which Secretary Seaton was the principal speaker. The Post Office Department issued a commemorative postage stamp, depicting the tower, in honor of the anniversary and it was first placed on sale at the monument post office on that date.

New developments at Colter Bay, Grand Teton National Park, were shown to the public at an open house there on June 16, at which time also a plaque commemorating the explorations of John Colter and his discovery of the Tetons 150 years ago was unveiled. Erection of the plaque was jointly sponsored by the Wyoming State Historical Society and the National Park Service.

"Campfire Day," September 19, was observed widely throughout the Service, primarily by and for Service concessioner employees. It was on September 19, 1870, that the proposal was made around the evening campfire of the Washburn-Langford-Doane expedition that the Yellowstone be set aside as a national park. August 25 is the anniversary date of the passage of the Act establishing the National Park Service; 1956 was the 40th anniversary year. Designated as Founders' Day, observance of the anniversary provided an opportunity for park staff to acquaint many thousands of visitors with something of the history and ideals of the Service.

Protection of Park Wilderness

The Mission 66 report, completed in mid-1956, made plain the Service's continuing concern for the protection of wilderness in the National Park System. In order to provide information to those interested in this phase of national park administration, the Service produced and distributed rather widely a statement entitled "Preservation of Natural and Wilderness Values in the National Park System." The same subject matter, in somewhat shortened form, is to be presented in a handsome brochure, to be entitled "The National Park Wilderness." Funds donated for the purpose will defray the costs of production. It will be in a format similar to that adopted for "Our Heritage" and "Our Vanishing Shoreline."

PROGRESS ON MISSION 66

The Mission 66 program has reached its first anniversary, and orderly progress can be reported as being right on schedule.

The major accomplishment of the Mission 66 staff during the year has been the review and approval of the final Mission 66 prospectuses for each area of the National Park System. These prospectuses are complete guiding documents which define the purpose, objectives, and plans for management, development, protection, and use of each area during the period of Mission 66. The prospectuses are still subject to minor revisions, refinements, or additions to improve the program or to adjust to changing conditions.

Brief editions of many park prospectuses were prepared and made available for distribution. These individual briefs have been valuable in gaining general public understanding of the program and in sustaining interest and support for its completion.

Public reaction to Mission 66 has been warm in its praise, and excellent newspaper coverage has featured articles on the general program as well as on individual area development projects. Anniversary celebrations, dedications, talks to service groups, area "show

me" days, and press releases on individual area programs have kept Mission 66 before the public. It has greatly heightened public interest in conservation and recreation generally.

The third series of slide presentations, *Mission 66 in Action*, illustrating progress and accomplishments, was made available to field offices. The illustrations, assembled from a wide choice of colored slides showing current field progress in Mission 66 projects, and used in conjunction with a recording carrying the Director's commentary, were duplicated in quantity and widely used by field areas to keep the public fully informed about details of the Mission 66 program and to show significant progress in the accomplishment of its aims.

Two additional booklets have been prepared by the staff and will be released early in the fiscal year. These are the first annual progress report, *Mission 66 in Action*, and an illustrated presentation of the *Wilderness Statement*, a long-needed statement discussing the objectives, principles, and practices relating to the preservation of wilderness qualities in areas within the National Park System, reviewing the gains achieved over some 80 years of national park history, and presenting the plans which will insure the preservation of these essential qualities in the years ahead. The publication of these booklets was made possible by private funds donated by a friend of the Service.

The Mission 66 staff met with representatives of the United States Forest Service and the Fish and Wildlife Service, at their request, to review steps taken in the organization of Mission 66 as an aid in the formulation of similar type programs for their organizations.

The Mission 66 advisory committee of nine members chosen from field areas and the Washington Office continued to meet, as necessary, to make objective analyses of conclusions reached by the Mission 66 staff, and to provide the staff with suggestions, advice, and reactions representing the entire Service. To assure an active, alert committee, rotation of membership was placed on a 2-year basis and three members were replaced this year.

Work began on the development of a national recreation plan, one of the major objectives of the Mission 66 program. Included in this broad plan are a number of special studies. These include a national survey of outdoor recreation resources—a national plan for providing nonurban outdoor recreation resources at local, State, and national levels, with suggested procedures for accomplishment; the *Historic Sites Survey*, which will complete the national inventory of historical and archeological sites that should be preserved; and the *Historic American Buildings Survey*, which will be resumed to record and preserve measured drawings and photographs of existing monuments of the builders' art in the United States.

Mission 66 Legislation

Identical bills have been introduced in the 85th Congress, both in the House and the Senate, to implement Mission 66.

Generally the bills would authorize construction on Federal lands adjacent to but outside areas of the National Park System with the consent of the agency administering the land. They would clarify the authority for expending land funds on such incidental items as surveys, summaries, and appraisals. They would also permit the Service to obtain critical, expert, or consulting services without regard to the usual requirements for advertising and compliance with Civil Service Commission and classification regulations.

DESIGN AND CONSTRUCTION

Employment

Continued progress has been made in the staffing of the Field Design Offices. It is believed that the professional working force can now be maintained at an adequate level.

The student trainee and assistant programs have been fully utilized. In the summer of 1956 approximately 90 student architects, engineers, and landscape architects were on duty with the Western Office of Design and Construction and about 75 with the Eastern Office. The majority of these students were assigned to projects in the parks and monuments.

The work done by Public Health Service engineer reserve officers assigned to WODC and EODC in lieu of engineering vacancies has proved very effective.

Construction Funds

A great deal of credit is due the Design and Construction Division for advancing a sound economical construction program. Work progressed very satisfactorily and at the end of the fiscal year over 92 percent of the total construction funds apportioned for the year had been obligated or committed and some of the projects in the 1958 fiscal year program were being advertised.

Roads and Trails

Mission 66 accomplishments under the Bureau of Public Roads portion of the 1957 roads and trails program include the completion of 25 construction projects in 17 parks. Total obligations for these projects were \$9,242,415. Of this amount, \$7,393,932 was obligated directly for construction. Accomplishments include the completion

of construction of 7.761 miles of new roads, 2.129 miles of road in stage construction status, 98.496 miles of reconstruction of old roads, the building of 13 bridges, and such miscellaneous items as parking areas, guardrails, and tunnel linings.

Work completed under the minor road and trail program, administered and engineered exclusively by the Service, cost approximately \$2,400,000. It included the completion of approximately 39 miles of new road, 21 miles of stage construction on additional new roads, and reconstruction work on approximately 180 miles of old roads. In addition, work was completed on 25 miles of new trails and reconstruction on 32.5 miles of existing trails. The new mileage completed and under construction will provide initial developments in Cumberland Gap National Historical Park, as well as access to new visitor facilities at Cosby Campground at Great Smoky Mountains National Park, the new Canyon Village at Yellowstone National Park, and several new visitor facility developments at Lake Mead National Recreation Area and Cape Hatteras National Seashore Recreational Area.

Parkways

In the first year under the Mission 66 program, an \$11 million contract authorization provided by the Federal Aid Highway Act of 1956 advanced construction on national parkways. Of this amount, \$3,719,400 was for the Blue Ridge Parkway in North Carolina and Virginia, \$80,000 for the Chesapeake and Ohio Canal in Maryland, \$610,500 for the Foothills Parkway in Tennessee, \$2,156,400 for the George Washington Memorial Parkway in Maryland and Virginia, \$4,233,700 for the Natchez Trace Parkway in Mississippi and Tennessee, and \$200,000 for advance planning. These funds were concentrated on closing gaps in parkways construction and on additional public service facilities in developed areas.

Major parkways construction reached its highest volume since the program was begun in 1933. As of June 30, 1957, approximately \$17,600,000 worth of contracts were in process under the Bureau of Public Roads program, including 92 miles of grading and base course, 17 bridges, 7 grade separations, tunnel lining, slope stabilization, and guardwalls.

Major parkway contracts costing approximately \$8 million were completed on 24 major projects, including 29 miles of grading, 22 bridges or grade separations, 30 miles of final paving, tunnel lining, guardrail, and other work.

Approximately \$8 million was expended to complete the 23-mile Colonial Parkway connecting Yorktown and Jamestown in time for the 350th anniversary celebration.



FIGURE 29.—Closeup of the Lower Falls, Yellowstone National Park. The drop of the Lower Falls, 308 feet, is nearly twice that of Niagara. The Upper Falls, not far above, drops 109 feet with a thundering roar. Note the photographer down in the canyon near the base of the Lower Falls.

Master Plans

Adjustments in the master plans are proceeding as a logical step subsequent to the approval of Mission 66 prospectuses.

The preparation of master plans before construction drawings are prepared is essential to assure logical and economical development. Therefore, our objective is to advance the master plans well ahead of the current construction program. We have made some progress in the past year in catching up with the backlog and further improvement is anticipated. During the 1957 fiscal year 134 master plan drawings were approved. In addition 388 preliminary studies were prepared.

Buildings

One of the principal and most effective phases of the provision of Mission 66 has been buildings essential for public service. Facilities for making the visits to national parks more enjoyable and to provide for their comfort and convenience is nowhere more apparent than in the buildings program. The first year of Mission 66 has seen completed and put in operation visitor centers at Jamestown and Yorktown in Colonial National Historical Park, Grand Canyon, Carlsbad Caverns, and Olympic National Parks, Fort Frederica National Monument and Fort Caroline National Memorial, and a library addition at Morristown National Historical Park. Work is in progress on visitor centers at Chalmette National Historical Park, at Everglades, at Colter Bay in Grand Teton, and at Canyon in Yellowstone National Parks, and at Dinosaur, Chaco Canyon, and Organ Pipe Cactus National Monuments. Plans are in preparation, with early contracts expected, for like structures at Grand Teton and Mammoth Cave National Parks, and Craters of the Moon National Monument. At Mount Rushmore an amphitheater for 1,800 persons, complete with audiovisual equipment, has also been completed and soon will be placed in use. Two lodging units containing 32 rooms with baths have been completed at Isle Royale National Park and a large concessions building with restaurant, lounge, and other facilities at Mount Rushmore National Memorial.

Modern comfort stations have been constructed in new and enlarged campgrounds in Grand Teton, Yellowstone, Everglades, and many other parks and monuments; 56 such buildings were completed, with 25 others under construction or ready for contracting. Of lesser interest but essential to the operation and protection of the parks are 9 new administrative facilities, 24 maintenance buildings, and 103 employee housing units completed or in course of construction with a number more in the planning stages.

Notable progress has been made on the reconstruction of historic buildings. Work has been completed or is underway at Independence Hall where new electric, fire alarm, and heating systems have been installed, new public restrooms provided, and general rehabilitation work accomplished. Nonhistoric buildings within Independence National Historical Park are being demolished to provide a proper setting for the historic buildings. Basic architectural research, reports, and measured drawings of historic buildings have been made at Adams, Harpers Ferry, Appomattox Court House, Andrew Johnson, Hampton, and Fort Laramie, and restoration work has been completed on some of the buildings.

The concessioners in Yellowstone, Grand Canyon, Grand Teton, and Glacier National Parks have kept pace with the Service in providing new and improved facilities in the form of stores, lodges, and overnight accommodations for visitors, and dormitories for their employees. The Service has installed the utilities and constructed the roads, trails, and parking areas to serve these improvements.

Utilities and Miscellaneous Structures

Construction for the first year of Mission 66 included the completion of 48 water system projects costing approximately \$1,825,000, and providing a net increase in available water storage of about 3,850,000 gallons; 38 sewer system projects representing an investment in new facilities of about \$713,967; new marine structures including several small piers, docks, floats, and a mile of shoreline protection at Colonial National Historical Park costing \$280,000; extensive sand fixation at Cape Hatteras amounting to \$102,270; and major repair and restoration of the Victory Monument at Yorktown, Virginia, at a cost of \$205,334.

Negotiations were also completed for the borrowing of 500 tons of airplane landing mat sections from the Navy Department, Bureau of Yards and Docks, which were in turn lent to the State of North Carolina for interim stabilization of several miles of road through a portion of Cape Hatteras National Seashore Recreational Area.

Through the medium of the cooperative agreement with the Public Health Service and the extensive research facilities of that Service a study and analysis of present sewerage facilities and future needs at Mammoth Cave National Park was completed. By this means a quantity of newly developed technical data was accumulated, useful in developing improved design criteria in the field of sanitary engineering.

A comprehensive study of electric generating and distribution systems and future requirements at Yellowstone National Park was

made. A complete new set of specifications for purchase of NPS frequency-modulated radiophones and accessories was prepared and distributed. The Service's radio testing facilities were discontinued and arrangements made for the Forest Service to test and certify our future radio equipment at considerable savings.

Civil Defense

The Division of Design and Construction participated actively in Operation Alert 1956 under a preplanned decentralized Emergency Operations Organization coordinated with the departmental program.

INTERPRETATION

The National Park Service's success in meeting its responsibilities as trustee for the 182 areas it administers is gaged more by the effectiveness of its work of interpretation than by any other phase of its activities.

Not only does Mission 66 recognize this fact fully; already its results in enlarged and improved interpretive facilities are evident in a number of locations, and the coming year will see still further advances. Hand in hand with these physical improvements goes a constant search for better means and more effective methods; staffing approaches closer to adequacy for the tasks which we face; planning for the future becomes more exact and seeks full coordination with the provision of facilities.

Services to the Public

Increases in both facilities and staffs resulted in increases in the numbers of persons receiving interpretive services at a higher rate than the gain in total numbers of visitors. The count of interpretive services was nearly equal to the number of visitors to those areas where such services were offered (98 percent) by contrast with the preceding year when it was 91 percent. The greatest rate of gain was at visitor centers and other attended stations which recorded an increase of 4,700,000 to a total of almost 18 million. Over 5 million persons heard campfire or orientation talks and 2,285,000 took conducted trips led by trained naturalists and historians.

Staffing

Increases in permanent interpretive employees included a chief park naturalist at Bryce Canyon, assistants at Mammoth Cave and Hawaii National Parks, and historians at Mount Rushmore, Fort

Laramie, and Jefferson National Expansion Memorial. There was also some increase in seasonal ranger naturalists, historians and archeologists. Increases in park ranger and maintenance staffs have helped, by relieving interpretive staffs of some of their extraneous duties.

Visitor Centers

Outstanding among the many useful ideas that have resulted from the creative and forward-looking thinking of Mission 66 has been the visitor center which provides, at one or more places in each field area, focal points for informational and interpretive services.

Such a center, constructed during the year at Grand Canyon well illustrates the principles which apply to location, arrangement and content. It is situated on the main park road a few miles inside the south entrance, past the overlook where most visitors get their first, breathtaking view of the Canyon itself.

In the lobby, the visitor finds an information desk manned by a uniformed ranger equipped to answer their questions and to provide them with literature and maps. Lobby exhibits suggest the significance and extent of the park.

In a room across the patio a brief, continuous illustrated talk will help him plan his visit wisely. Or he may step into the park museum where a great variety of exhibits, arranged in orderly and effective fashion, enable him to obtain a more complete story of the canyon—both its natural and human history.

The center is headquarters for the park's whole interpretive program. Here the park naturalist has his office; here are the study collections, naturalist workshop, and library. The visitor is welcome to make use of the library, and the student to consult the study collections.

Here, too, the superintendent has an office where he can maintain contact with those who come to the park. In effect a one-stop service unit, it functions effectively and economically.

The Jamestown and Yorktown visitor centers, situated at opposite ends of the Colonial Parkway, were opened in time for the Jamestown Festival, celebrating the 350th anniversary of the founding of the colony of Virginia. Each offers information facilities, an auditorium, and a museum. The Yorktown center contains also the park's headquarters. The center at Jamestown is shared with the Association for the Preservation of Virginia Antiquities which owns part of Jamestown Island, and here are housed the park's extraordinarily rich study collections. Having learned where to look, what to

see, and something of what happened here, the visitor may walk directly to sites of great historic interest.

The Jamestown museum makes effective use of objects excavated at the townsite and of corresponding 17th century specimens from Europe to tell the story of the island and the colony. Among the exhibits in the Yorktown museum are the two tents which George Washington used throughout the Revolution. The large dining tent was used at Yorktown in 1781 for the banquet Washington gave the British officers after the surrender.

Sixteen other visitor centers were under construction or completed during the year. Planning and preparation of exhibits kept pace as closely as possible with building construction. However, for more rapid production of exhibits, plans were made for opening a second museum laboratory in San Francisco as soon as space for it is available.

Roadside Interpretation

In both scenic-scientific and historical areas of the National Park System, progress in providing interpretive signs, markers and exhibits along both new and old roads attests the Service conviction that only when these have been provided can a park road be said to be complete. New roads approaching completion—the highway along the east side of Jackson Hole in Grand Teton National Park, the Stevens Canyon Road in Mount Rainier National Park, and the Heart-of-the-Hills Road in Olympic National Park, for examples—will be equipped to provide such opportunities.

A distinctive series of interpretive markers was placed on the just-completed Colonial Parkway, in Colonial National Historical Park. Roadside interpretive painting exhibits along the Jamestown Loop Tour Road are a decided innovation. Interpretation of the "New Towne" section of Jamestown makes use of partly restored fences, hedgerows, and ditches, a series of reconstruction drawings, markers, and recordings. There are significant new marker installations and other interpretive devices at Acadia, Wind Cave and Grand Canyon National Parks, Badlands, Colorado, Dinosaur, Black Canyon of the Gunnison and Wupatki National Monuments, Theodore Roosevelt National Memorial Park, and Kennesaw Mountain National Battlefield Park.

A committee representing the Divisions of Interpretation and of Design and Construction has formulated a set of guidelines and standards to help field areas in developing and installing roadside interpretive facilities. These are scheduled for early publication.

Self-Guidance

The annually increasing numbers of visitors to the parks continues to require the expansion of the system of self-guiding trails and, less numerous, roads. Self-guiding trails marked by numbered stations with references to a printed booklet or folder now number more than 100; they serve immense numbers of visitors whose schedules do not permit them to take conducted trips or who prefer more leisurely exploration of the trails. Three new self-guiding trails have been installed in Yosemite, and one each in Great Smoky Mountains National Park, and at Colorado, Devils Tower, Fort Union, Coronado, and El Morro National Monuments, Theodore Roosevelt National Memorial Park, and Kennesaw Mountain National Battlefield Park.

An important interpretive accomplishment was the establishment of a self-guiding tour system for the battlefields of Fredericksburg, Chancellorsville, The Wilderness, and Spotsylvania Courthouse. At Castillo de San Marcos National Monument a series of visitor-activated recordings of brief interpretive talks have become the major medium of interpretation. In Independence Hall, exhibits placed in the Supreme Court Chamber and the East Wing have helped visitors to grasp the Service's restoration program in progress there.

Self-Guidance Publications

There has been a noticeable and steady improvement in both the appearance and the content of self-guidance publications. Earlier mimeographed sheets are being replaced by well-illustrated and well-printed booklets, with the Southwestern Monuments Association and Loomis Museum Association setting the pace. The Mountain Farm Trail booklet for the Blue Ridge Parkway and the Sunset Point Nature Trail booklet for Mammoth Cave National Park, produced by the Eastern National Park and Monument Association, an official cooperating society serving many areas in the East and South, well exemplify the progress being made in this specialized publications field. While some self-guidance publications are printed at the Government Printing Office, many more are produced by cooperating organizations.

Use of Audiovisual Devices

There was an increase of more than 50 percent in the use of audiovisual aids to supplement personal services in interpretation throughout the National Park System during the year. An audiovisual committee of the Division of Interpretation gave direction to the planning involved in this expanded activity and to the programing



FIGURE 30.—Yosemite Valley from the Wawona Road Tunnel looks practically the same as it did when the first white explorers in pursuit of Indians entered the Valley in 1851. From this point no trace of human development may be seen although the view encompasses much of the seven-mile long Valley with El Capitan rising 3,604 feet on the left, Clouds Rest and Half Dome in the distance, and Cathedral Rocks and Bridalveil Fall appear on the right.

of Mission 66 construction funds for it. Ten different types of installations, in 52 separate units, were placed in operation. Included among these types were: Automatic devices, including "talking labels"; outdoor electronic self-guiding systems; 30-slide capacity, console-type slide projectors; an experimental, 60-slide capacity, dissolve-face projection and sound system; 16 mm. optical-magnetic film projectors combined with public address systems; semiautomatic slide-projector-tape recorder units, with synchronized sound; and magnetic tape-recorder reproducers.

"Talking labels" have been used in connection with dioramas and electric maps in museums and for brief interpretive talks. Much improved slide-sound installations have already abundantly proved their usefulness in presenting "What to see and do" talks in several new visitor centers.

With the help of regional offices and the superintendents and their interpretive staffs, it was possible to improve the annual programming of audiovisual installations to meet urgent needs, especially for the new visitor centers, amphitheaters, and campfire circles being provided under the Mission 66 program.

Historical Restorations and Demonstrations

The year saw the beginning and, in several instances, the accomplishment of varied and important projects for restoration of historic structures and their surroundings to conditions closely approximating those of the time commemorated by them. Attracting probably the greatest amount of public attention and acclaim was the 17th century-type glasshouse built at Glasshouse Point, Colonial National Historical Park, by the Jamestown Glasshouse Foundation, Inc., and placed in operation for the actual blowing of glass containers on April 1. The foundation was established by the leading glassmaking companies of the United States.

At Jamestown also the completion of the Colonial Parkway included the restoration of the isthmus which connected Jamestown with the mainland from 1607 until the American Revolution.

At Hopewell Village National Historic Site, in Pennsylvania, the obtrusive modern road which bisected the old iron-furnace village was eliminated; the historic landscape, grades, elevations, and slag roads were restored. On the Natchez Trace Parkway, Mount Locust, the one-time frontier home and inn, was restored and dedicated. A beginning was made on the restoration of the historic covered bridge at Wawona, in Yosemite National Park.

Excavations at Fort Sumter National Monument brought to light long-hidden portions of the old fort, which the public may now see for the first time in nearly a century. Excellent progress was made in stabilizing officers and noncommissioned officers quarters at Fort Laramie National Monument.

Work on the restoration of the first floor of Independence Hall, in Independence National Historical Park, continued with the meticulous care that has been used from the beginning.

Research

In the National Park Service, research is one of the important means which enable it better to meet its responsibilities. Historical research is done largely by its own historians. In other fields it is accomplished in various ways. Service employees contribute importantly to it, but it leans heavily also on the cooperation of other

Federal agencies, State agencies, and publicly and privately supported institutions of higher learning.

During calendar year 1956, 160 research projects were performed by regular and seasonal members of the Service, collaborators and cooperating groups and individuals. Of these, 148 dealt directly with the areas administered by the National Park Service, 4 were in the category of investigations of proposed areas, and 8 were general research projects. Graduate students and staff members of 23 colleges and universities, and 4 private individuals participated in these projects. Five Federal agencies, 7 State agencies, and 3 professional societies also performed research or assisted field personnel in research projects.

Natural science research during the year dealt with such matters as siltation at Mammoth Cave National Park; the ecology of Florida Bay, in Everglades; hydrothermal phenomena at Yellowstone; and the ecology of high mountain meadows and other fragile environment in several National Parks. The Coastal Studies Institute of Louisiana State University and the Office of Naval Research cooperated in detailed research on the geology, botany, archeology, and history of Cape Hatteras National Seashore; North Carolina State College is doing further research there in biology. Seven major geological research projects were in progress in Death Valley National Monument alone.

Texas A. & M. College and the Texas Fish and Game Commission are participating in a 5-year study of Big Bend National Park ecology. Biological and geological studies are under way in Virgin Islands National Park, the University of Kansas and Princeton University cooperating.

Historical research included studies of the appearance and use of Independence Hall at various periods; of details of colonial life and land ownership at Jamestown; of the locations of specific features at Fort McHenry, a necessary basis on which to prepare development plans; and a study of the historic structures remaining at Harpers Ferry.

Archeological methods were employed at such historic places as Fort Frederica and Fort Union National Monuments, at Jamestown, at Independence and Cumberland Gap National Historical Parks, and, on a minor scale, at a number of other areas. Important archeological research was continued by the University of Colorado at Mesa Verde, by the University of Southern California at Death Valley, by the University of California at Yosemite, and by the Bishop Museum of Honolulu at the proposed City of Refuge National Historical Park. Washington University, St. Louis, cooperated in the

effort to find the original site of Arkansas Post. Service archeologists excavated at the site of Fort Clatsop, in Oregon.

Under cooperative agreements, 16 universities and colleges and the Smithsonian Institution performed river-basin archeological salvage. In addition, the University of Utah, the School of American Research, and the Museum of Northern Arizona undertook such salvage in the Upper Colorado Basin. The Smithsonian, working at 11 reservoir sites with funds supplied by the Service, recorded more than 200 new archeological sites, excavated 19, and processed more than 179,000 excavated specimens.

The Problems of Wildlife

Visitor interest in the animals of the parks, and the important part played by the National Park System in maintaining wildlife populations in their natural environment require Mission 66 projects to avoid damage to habitats and yet assure the visitor opportunities to see, enjoy, and learn about the wildlife of the parks.

The needed stronger program of biological studies now being planned will include stronger cooperative relationships with the Fish and Wildlife Service and more cooperative research with other qualified organizations.

Protection of sufficient forage and range for the larger hoofed animals continues to be a major problem. Control of elk within range capacity has been carried on satisfactorily at Yellowstone, Grand Teton, Rocky Mountain and Wind Cave National Parks. Direct control is used only when outside hunting proves inadequate. Bison were reduced at Yellowstone and Wind Cave and at Colorado National Monument.

Bison reintroduced last fall in Theodore Roosevelt National Memorial Park came through the winter well. The animals were provided by the Fish and Wildlife Service from its Niobrara National Wildlife Refuge.

Varied problems continue to face the Service in protecting and managing wildlife resources. Black bears require constant attention to prevent personal injury and damage to property. Rare and endangered species, of which numerous kinds find refuge in the parks, deserve and get constant special attention.

Information on Mission 66

Wide public interest in all phases of Mission 66 placed far heavier than normal demands on the information staff of the Washington Office and on field and regional offices. Of the press releases it issued through the Department, more than 40 percent dealt directly with

one phase or another of Mission 66. In addition, as a matter of public service, superintendents issued much information to the press on Mission 66 programs and activities on the areas in their charge.

Publications

New items among Service sales publications, which now number 90, included historical handbooks on Washington's Birthplace and Ocmulgee National Monuments and Chickamauga-Chattanooga National Military Park; the Saguaro Natural History Handbook; and a new Archeological Research Series item, Archeology of the Funeral Mound, Ocmulgee National Monument, Ga. Eight new informational publications were produced for areas or features which previously had had none. A 32-page booklet on the park system of the National Capital replaced one of half that size. New format booklets were produced for Yellowstone, Yosemite, Grand Teton and Bryce Canyon National Parks.

Revisions of all Service publications, free or sales, dealing with Colonial National Historical Park, were issued to meet the needs of those attending the Jamestown-Williamsburg-Yorktown celebration. A new sales publication, "New Discoveries at Jamestown," embodied the results of extensive archeological excavations there over a 2-year period.

The 125 free informational publications ordered during the year totaled 8,778,000 pieces of printed matter. The Washington Office received 44,435 written requests for literature.

RECREATION RESOURCE PLANNING

Preparations to augment the Service's recreation resource planning program, as a part of Mission 66, were under way throughout the year. These additional cooperative services will begin with the new fiscal year. The Service, in cooperation with other Federal agencies and the States, will assist in formulating State, regional and national plans for the preservation, development, and use of outdoor recreation resources. Such comprehensive planning is based on recognition of the fact that public use of the nonurban recreation resources of the Nation is increasing tremendously with a rapidly growing population, a shorter workweek, and improving transportation facilities.

New Areas Established

The establishment of Virgin Islands National Park on December 1, 1956, has been noted elsewhere in this report. The Chimney Rock National Historic Site, near Baird, Nebr., was designated on August

9, 1956, and the Golden Spike National Historic Site in Utah on April 2, 1957. Both are in non-Federal ownership. The Booker T. Washington National Monument, Va., was established on June 18, 1957, upon acceptance of title.

New Areas Proposed

A bill was introduced, but not acted upon, to establish Dinosaur National Park in Colorado and Utah, to include substantially the lands in Dinosaur National Monument. Pursuant to legislation, the site of Fort Clatsop in Oregon, winter headquarters of the Lewis and Clark Expedition, was investigated. The Wheeler Peak region in the Snake Range of eastern Nevada was investigated jointly with officials of the Forest Service for possible National Park or Monument status; additional studies will be necessary.

At the request of and in cooperation with officials of the State of Maine, Service representatives participated in a reconnaissance survey of the Allagash River region in northern Maine.

The investigation and report to Congress on the advisability of establishing a national monument in Brooklyn, N. Y., in honor of the Maryland soldiers who fell during the Battle of Brooklyn on August 27, 1776, was completed in accordance with the act of August 3, 1955 (69 Stat. 445). It was recommended that the proposed national monument not be established. Other legislative proposals included bills to accord national park status to Petrified Forest National Monument, and the National Historical Park status to the 170 miles of the Chesapeake and Ohio Canal and certain adjoining lands, between Great Falls and Cumberland, Md., significant for their historic, scenic, and recreational values.

Area Abolishments

The Congress authorized abolishment of two national monuments judged to be lacking in national significance: Verendrye National Monument, turned over to North Dakota for historic site and other purposes, and Fossil Cycad, South Dakota. Disestablishment of the latter will take place in September 1957.

Boundary Adjustments

By secretarial order of March 22, 1957, about 11,000 acres were excluded from and 240 acres added to Badlands National Monument in South Dakota. The Mikveh Israel Cemetery in Philadelphia was authorized by act of Congress of August 6, 1956, as a unit of the Independence National Historical Park subject to the proviso that the

United States would not assume responsibility for its administration, care, and maintenance. Secretarial approval of proposed boundaries for Pea Ridge (Arkansas) and Horseshoe Bend (Alabama) National Military Parks made possible the start of land acquisition for donation to the United States. Pursuant to legislation, 165.80 acres were added to Pipestone National Monument, Minn., by secretarial order.

Bills were introduced to revise the boundaries of Everglades National Park, Florida; Grand Canyon National Park and Monument, Arizona; Sequoia and Kings Canyon National Parks, California; Lake Mead National Recreation Area, Arizona-Nevada; Fort Fredricka National Monument, Georgia; Shiloh National Military Park, Tennessee; Whitman National Monument, Washington; and Cowpens National Battlefield Site, South Carolina. A bill before the Congress would authorize acquisition of property on the Michigan mainland for Isle Royale National Park headquarters.

Public hearings were held at Cedar City, Utah, on June 12, 1957, on withdrawals to add lands to Zion National Park and Capitol Reef and Arches National Monuments. General approval of the proposals was expressed.

Threats to the National Park System

A proposal to erect a sewage treatment plant on privately owned, vitally important historical land between the two segments of Chalmette National Historical Park, Louisiana, greatly affects the park's future.

The proposed River Bend Dam on the Potomac River above Great Falls, if constructed, would submerge some 35 miles of the Chesapeake and Ohio Canal and other areas of historic, scenic, and recreation value.

"Park Practice" Program

Appreciable momentum has been developed in the park practice program, started in 1956 as a joint effort of the National Conference on State Parks and the Service for exchanging ideas and experiences on park policies, practices, and solutions to problems. Subscribers now receive from the Conference at least 32 design sheets a year illustrating various types of park and recreation structures developed by local, State, and Federal agencies. They also receive *Grist*, an 8-page, illustrated, bimonthly information letter on operational procedures, time and money-saving devices and methods, and "tricks of the trade." The Conference and the Service have approved a prospectus for periodical issuance of guideline material dealing with all

policy aspects of park administration. It is believed that this three-part program inspires closer cooperation among park agencies and reduces duplication of effort.

Advisory and Consultative Assistance

The Service assisted 47 of the States and the Territory of Alaska on various aspects of their park programs. Most encouraging was the enactment of legislation by Arizona and Utah creating for the first time State park agencies and authorizing establishment of comprehensive State park systems. The Service is happy to have been of some help in bringing about these forward steps. A significant accomplishment was the preparation, in collaboration with the Bureau of Land Management, of a master-plan report for the protection and development of the Junction Butte-Dead Horse Point recreation area in southern Utah which has exceptional scenic and educational value.

Disposal of Real Property

As required by law, the Service investigated and reported upon 26 applications submitted by State and local agencies to General Services Administration and other disposal agencies to acquire surplus Federal properties for park, recreation, and historic monument use. The Service also reported to the Bureau of Land Management on 30 applications by State and local agencies to lease or purchase public domain lands for park and recreation use.

State Park Statistics—1956

This publication, prepared from information gained through a questionnaire survey, reveals 2,100 State parks and related types of recreation areas, containing more than 5 million acres; expenditures of \$28 million for land and capital improvements and \$38 million for operation and maintenance; 6,048 year-round employees and 8,884 seasonal employees and more than 200 million visitors. Nine million of these were tent and trailer campers, double the number of 4 years ago.

Regional and Basinwide Surveys

Field work for the Missouri River Basin-Wide Recreation Survey is largely completed and the report is being drafted. Investigations of the recreation potentialities of the Delaware River Basin were continued by the Service as a part of the cooperative survey of the Dela-

were basin in which the Corps of Engineers, other Federal agencies, and four State agencies are participating.

The Recreation Subcommittee of the Columbia Basin Interagency Committee, which represents all Federal and State agencies of the basin dealing with recreation, published a report entitled "Recreation Areas and Facilities, Pacific Northwest Region." Continued cooperation and assistance were extended to the Columbia River Gorge Commission in connection with studies and advice relating to land acquisition for protection of the scenic character of the gorge. Recreation master plans for strategic areas of reclamation-withdrawn lands of the Lower Colorado River were prepared and transmitted to the Bureau of Reclamation for review.

Protests were made against proposals in the California Water Plan for reservoirs on the Middle Fork of the Tuolumne River and in the Wawona area of Yosemite National Park. The reservoir on the Middle Fork has been eliminated from the plan.

Special Recreation Surveys

Studies to determine the remaining opportunities to conserve natural areas along the Pacific coast and the Great Lakes shore were begun with donated funds. The studies will be similar in character and scope to the survey of the Atlantic and Gulf coasts completed in 1956.

Memorandums of agreement were negotiated and approved by States and their political subdivisions covering administration of eight reservoirs constructed by the Bureau of Reclamation. Recreation sections of reservoir management plans were furnished the Bureau for eight reservoirs.

The Service prepared for the Bureau of Reclamation 10 recreation reconnaissance reports, 5 planning reports, 10 letter reports, and 1 development plan, and for the Corps of Engineers 9 recreation reconnaissance reports. Thirty-nine applications for Federal Power Commission permits and licenses were reviewed.

National Survey of Outdoor Recreation Resources

A prospectus was drafted summarizing the major objectives of a study directed toward the formulation of a national plan to provide nonurban outdoor recreation areas and facilities at local, State, and Federal levels, and outlining suggested procedures. This nationwide study, to be started during the fiscal year 1958, is a major phase of Mission 66.

The survey of the recreation resources of northwestern California is nearing completion.

A master plan was prepared for the recreation development of lands of the Colorado Tribes Agency near Parker, Ariz. A recreation subcommittee has been organized by the Pacific Southwest Field Committee.

Reservoir Development and Management

Pursuant to a memorandum of understanding between the Region 4 office of the Bureau of Reclamation and the Region 3 office of the Service, recreation planning for authorized projects of the Upper Colorado River Storage project was initiated. To date, planning reports have been prepared for five reservoirs, including the Wahweap portion of the Glen Canyon Unit. Recreation planning of the Glen Canyon Reservoir area, one of the most scenic regions in the Southwest, is being directed toward its ultimate designation as a national recreation area.

Progress was made in negotiations for transfer of the Millerton Lake national recreation area to the State of California for administration.

OPERATIONS

The protection of scenic, scientific, and historic values in the national parks and monuments, assistance to and protection of the many millions of visitors who enjoyed them, the regulation of concessioner operations, the acquisition of much privately owned land, and the maintenance of physical plants—these comprise the major responsibilities of the Division of Operations.

During the past several years the division has gained considerably in experience and has improved its effectiveness. However, the additional responsibilities and the new or enlarged problems brought about by Mission 66 and the steadily mounting number of visitors using the national parks and monuments have resulted in a large increase in the workload handled in the Washington and Regional offices. In order to determine the most efficient way to meet this increased workload, a study of the organizational structure of the division was undertaken with particular attention to protection activities.

Park Rangers

The rapidly increasing volume of public use of the parks, with its attendant problems of protecting the visitor and the natural features, historic structures, and other resources, has placed a severe strain on the relatively small protection staffs. In addition to providing



FIGURE 31.—Mount Rainier National Park, Washington. Saddle party on the Wonderland Trail at Klapatche Lake; Mount Rainier rising high in the background.

necessary protection and prevention of detrimental activities, park rangers furnish many public services of importance, such as information and guidance, and exercise such controls as are needed for the safe, orderly, and beneficial use of the areas.

The long overdue improvement in the classification structure of park protection positions continued to receive attention; and favorable action was taken on a number of ranger position descriptions and reassignments.

Intensive training of protection personnel in the specialized activities in which they engage continues to receive attention.

Forest Fire Control

Despite several very critical fire hazard periods and steadily increasing public use, the total number of man-caused forest, brush,

and grass fires, in the National Park System continues to show a steady decline. Also, the rising trend of camper-caused fires noted in recent years was reversed and the acreage burned over by all fires was well below average. In contrast, lightning caused more fires than during any previous year, so that the total number of fires was greater than normal.

Forest Pests

Forest pest control projects in the national parks receive technical guidance from the Division of Forest Pest Control of the Forest Service, United States Department of Agriculture, and this direction has been most helpful in protecting park vegetation.

The program for protection of the picturesque subalpine five-needle pines in western parks from white pine blister rust is well developed and control work is advancing on schedule. These trees, not now being protected generally by any other agency, will provide valuable samples for future observation. The control of dwarf mistletoe on ponderosa pine in the forests of Grand Canyon was extended to include a fine stand of pine, along the route of the new East Rim Road. Intensive research has been continued to find a means of controlling the destructive lodgepole needleminer, which threatens to destroy pines on 550,000 acres within Yosemite National Park. The epidemic of southern pine beetle in Great Smoky Mountains National Park is being steadily reduced under an aggressive control program.

An unusual amount of storm damage to shade trees in areas generally located east of the Mississippi River, including cemeteries, increased the need for special arboricultural work.

Maintenance

Because of continued difficulty in recruiting maintenance personnel, particularly engineers, a study of each position was made throughout the Service to assure proper distribution and maximum use of the professional skills required to maintain physical plants. A new system for collecting workload data used to determine actual maintenance requirements and to complement the programing system initiated last year was put into operation. This information provides comparison, on a unit-cost basis, of maintenance operations throughout the Service, permitting management to determine more clearly overall needs and efficiency.

Public demand for the earlier opening of park roads was met this spring in several areas by starting snow removal operations several weeks earlier than had been undertaken in the past.

Travel to the Parks

Public use of the areas administered by the National Park Service broke sharply upward in 1956. The increase was at a rate double that of the 5 percent rise in 1955, and the most violent upsurge since mid-1952. Visits in 1956 totaled 54,923,000, up 10 percent from 1955. It now seems likely that public use in 1958 will be three times that of 1946.

Travel Survey

Publication of the final report on the Great Smoky Mountains National Park travel survey is expected momentarily. This survey, conducted by the State Highway Departments of North Carolina and Tennessee in cooperation with the National Park Service, will discuss the travel characteristics associated with that Park in great detail.

Control Schedules Revised

Mission 66 control schedules were revised to allow for adjustments resulting from approval of park development prospectuses; the addition of new areas to the system; the inclusion in the Mission 66 program of development costs for which separate authorizations had been anticipated when the original schedules were prepared; and provision for increases in construction costs.

New Procedure for Construction Proposals

A comprehensive check list, prepared by the Eastern Office of Design and Construction, was issued to insure that consideration is given to all of the components required for various construction projects. Use of the list will result in the submission of more complete data from which to prepare construction drawings and cost estimates. Construction cost indices are issued periodically, so that estimates are always based on current costs.

Delegation of additional programing functions to the regional offices has materially reduced the flow to the Washington Office of correspondence concerned with final decisions on projects making up the programs.

Flexibility in Reprograming Authorized

The Appropriations Committees while considering the 1958 budget, recognized a need for greater flexibility in the construction programs of the Service. The Report on the Interior and Related Agencies

Appropriations Bill by the House Committee on Appropriations “* * * authorized the Director to make such adjustments in the construction program as become necessary due to unforeseen circumstances, provided they are made within the fiscal year fund limitation and are within the overall 10-year program.” The Senate Committee on Appropriations took no exception to the statement in the House Report.

Use of Future-Year Contract Authorization

Roads and trails and parkways construction was facilitated greatly through use of authority provided by the Federal-Aid Highway Act of 1956 to incur contract obligations in 1957 for projects programed for the 1958 fiscal year.

Land Acquisition

During the year \$1,300,000 was made available for land acquisition, of which \$400,000 was donated. Some 52,500 acres of inholdings were acquired by purchase, donation, or exchange.

Donations included some 220 acres from the Commonwealth of Virginia and 1,050 acres from the State of North Carolina for Blue Ridge Parkway; 1,025 acres from North Carolina for Cape Hatteras National Seashore; 10,530 acres from the Territory of Hawaii for Hawaii National Park; and 225 acres from the State of Tennessee for the Foothills Parkway. Virgin Islands National Park was established on December 1, 1956, when the Secretary accepted donations of 420 acres from Caneel Bay Plantation, Inc., and 4,665 acres from Jackson Hole Preserve, Inc.

Completed purchases and approved options cover some 7,500 acres of land and improvements in Big Bend, Glacier, Grand Canyon, Lassen Volcanic, Grand Teton, Great Smoky Mountains, Rocky Mountain and Yosemite National Parks; Badlands, Colorado, Joshua Tree, Organ Pipe Cactus, Petrified Forest, Saguaro and Sitka National Monuments; Gettysburg, Fredericksburg, and Guilford Courthouse National Military Parks; Colonial and Independence National Historical Parks; Fort Caroline National Memorial; and Theodore Roosevelt National Memorial Park. Awaiting acceptance at the end of the year were some 75 options totaling about \$585,000 and covering approximately 4,400 acres of improved and unimproved land.

Special Uses of Park Lands

Most special use permits issued during the past year continued to be for agricultural use of small parcels of land to maintain historical and rural scenes, for access to private lands from park roads, and for utility

lines. The number of requests for information on mining in the national parks and monuments and for vacation cabin sites in national recreation areas remained about the same as in previous years.

Water Resources and Rights

Progress in investigation of water resources and acquisition and protection of water rights continued, despite a shortage of investigation funds. With the \$31,182 available, only eight ground-water investigations were possible. Four State water-right licenses and one permit were granted. One licensed claim was surrendered when commercial power became available. Four new applications and two petitions for amendment of rights were filed. Four established rights were acquired and two more are in progress. Twenty time extensions were obtained, 2 conflicting claims protested, and 14 progress reports filed. Voluminous requested records were compiled to support claims to Lower Colorado River water in the Federal Intervention in *Arizona v. California* before the Supreme Court.

FIGURE 32.—Rocky Mountain National Park, Colo. View of Longs Peak from Rock Cut area on Trail Ridge road.



Concession Authorizations

Ten concession contracts and 24 concession permits were negotiated during the 1957 fiscal year. In connection with new contracts, construction programs were negotiated for Glacier National Park with the Lake McDonald Boat Co., and for Lake Mead National Recreation Area with Lake Mohave Resort, Inc. In the latter case, the concessioner agreed to expend \$150,000 during the first two years of the contract and has indicated a willingness to provide additional improvements as needed during the remainder of the contract period, with a total investment of approximately \$500,000.

Prospectuses

Five prospectuses were issued, soliciting offers for the operation of concession facilities at Olympic, Big Bend, and Mount Rainier (Ohanapeosh) National Parks, the Virginia portion of the Blue Ridge Parkway, and Coulee Dam National Recreation Area. No contracts have been negotiated as a result of these prospectuses, although offers have been received in response to the Blue Ridge prospectus. Offers in response to the Mount Rainier prospectus are not due until August 1, 1957.

Concessioners' Improvements

In Lassen Volcanic National Park, the Lassen National Park Co. completed a new store building and housekeeping cottages, costing \$165,000. These were dedicated on August 25, 1956. The Everglades Park Co. has completed a marine building and gasoline service station in Everglades National Park at a cost of \$54,000 and plans are underway for the construction of overnight facilities, to be in operation by December 1. The Yellowstone Park Co.'s Canyon Village development, consisting of lodge facilities costing \$2,822,175, was opened on July 1, 1956. The company also constructed an office building at Old Faithful and did other renovation and improvement work costing \$284,322. Hamilton Stores, Inc., will have ready for public use in July a store and gasoline service station at Canyon Village constructed at a cost of \$995,000. Through the efforts of the Mount Rushmore National Memorial Society of the Black Hills, a new concessions building has been constructed at Mount Rushmore National Memorial, costing approximately \$494,388. The Grand Teton Lodge Co. development at Colter Bay in Grand Teton National Park will be available during the 1957 season. It consists of cabins, cafeteria, store, etc., constructed at a cost of about \$2,000,000. Concessioners at Big Bend, Crater Lake, Rocky Mountain, Sequoia, Shenandoah, and Yosemite

National Parks and the Lake Mead National Recreation Area have also made improvements and completed building programs during the year.

General

Donald T. Knutson of Minneapolis, Minn., assumed the management of the Glacier Park Co. in Glacier National Park on January 1, 1957, under a management contract covering a 3-year period ending December 31, 1959. The contract may be extended for an additional 2-year period upon agreement between the parties.

ADMINISTRATION

Appropriations

The Service's financial position was greatly improved through the increased appropriations for the 1957 fiscal year, the first year of the Mission 66 program. While more adequate protection of park features and facilities, improved service to the public, and a higher standard of maintenance of physical facilities were made possible by the increases in the operating appropriations, the most significant improvement was the substantial increase in construction funds, making possible for the first time since World War II, a program, geared to need, for the construction of buildings, utilities, and other facilities. A comparison of the 1957 appropriations with those for 1956 is as follows:

| Appropriation item | 1956 fiscal year | 1957 fiscal year | Increase (+) or decrease (—) |
|---|---------------------|---------------------|------------------------------------|
| Management and protection..... | \$10, 443, 000 | \$11, 562, 000 | +\$1, 119, 000 |
| Maintenance and rehabilitation..... | 9, 094, 000 | 10, 158, 000 | +1, 064, 000 |
| General administrative expenses..... | 1, 250, 000 | 1, 250, 000 | -- |
| Construction..... | 8, 425, 000 | 15, 250, 000 | +6, 825, 000 |
| Construction (liquidation of contract authority)..... | 19, 654, 300 | 29, 800, 000 | +10, 145, 700 |
| Total cash appropriations..... | 48, 866, 300 | 68, 020, 000 | +19, 153, 700 |

Increase in Workload

Prosecution of the Service's expanded programs brought a substantial increase in the budget and finance workloads throughout the Service. Through organizational and procedural changes the additional workload was met in the Washington office without an increase in staff, and with very modest additional staffing in the field.

Program for Improvement in Financial Management

During the year the Service's program for improvement in financial management, which has been in progress for the past 4 years, was integrated with the governmentwide program as prescribed by the Bureau of the Budget in Bulletin No. 57-5, dated October 10, 1956. One of the major requirements was met as of December 31, 1956, when installation of the Service's new accounting system and financial reporting procedures in all of the field finance offices was completed. The Service's plan calls for completion of its financial improvement program with the preparation of a cost-based budget for the 1960 fiscal year. Financial management was further improved by reducing the number of field finance offices from 28 to 24. During the year such offices at Carlsbad Caverns, Crater Lake and Mammoth Cave National Parks, and at the Southwestern National Monuments Headquarters were closed and their functions transferred to the regional offices having jurisdiction over them.

Establishment of Imprest Fund Cashiers

Substantial improvement in the Service's procurement procedures was achieved during the year through the designation of imprest fund cashiers in 35 areas and offices. Under the new procedures many of the individual small purchases formerly handled on a charge basis are now paid for in cash, thus reducing clerical work and improving relations with business concerns from which the small purchases are made.

Personnel Work Increases

The work force of the Service, under the stimulus provided by the Mission 66 program, has continued throughout the year to enjoy a steady but conservative growth to meet growing responsibilities. In a growing organization, the volume of personnel work naturally increases and, as it increases, it is imperative that policies be suitably revised and that procedures be changed to meet new situations. The Branch of Personnel has been taking steps throughout the year to convert more fully to a staff advisory operation and to reduce materially the volume of cases handled on an individual basis.

Employee Development

To meet the challenges presented by the needs of a growing organization and by the difficulties of recruitment and retention which have arisen as a result of occupational shortages in several fields,

every effort has been made to expand and intensify employee training and development. A major move in this direction was the use of a questionnaire to gather full and detailed information concerning the character and effectiveness of training carried on throughout the Service in our field establishments. In conjunction with this survey, four strong "task forces" were established to develop concrete suggestions and recommendations for a comprehensive program of employee development. The task forces devoted their attention to the following areas of employee development: clerical and secretarial, professional and technical, trades and crafts, and supervisory and executive training. The Service's training officer was doing intensive work, at year's end, on the very valuable material and recommendations which were produced by these task forces.

Employee Training

Another major development in the field of training was the crystallization of plans for establishing a training center at a field location for the intensive training of new employees in the fields of protection and interpretation. Plans and arrangements for the new training center, in many respects a unique development in the Federal Government, were carried out so effectively that, at year's end, its establishment and operation at Yosemite National Park in fiscal year 1958 was assured.

The Service also conducted two of its general administration training courses this year, one in the Region 5 office, Philadelphia, and the other in the Region 2 office, Omaha. Both courses were attended by more than 25 picked fieldmen who received the benefit of 2 weeks of intensive instruction from the Assistant Director (Administration) and key staff members of the Washington and regional offices.

Position Classification

This was the first year in which the regional directors exercised classification authority; the results of limited delegation (through grade GS-7) were satisfactory. The caseload of classification actions in the Washington Office was reduced by this delegation to an extent which made it possible to devote a considerable amount of time to a major survey project—the complete review of key positions in all five regional offices. This review is still under way but is at least two-thirds complete. The other major project was the preparation of new class specifications for the park ranger series, to replace those adopted in 1948. At the year's end, the Civil Service Commission rescinded the old park ranger standards, pending completion of action on the proposed revision.

Employee Placement and Employee Relations

In the second half of the year a good start toward development of an employee relations program and a step-up of activity in the field of incentive awards was made when a new position of employee relations officer was established and filled.

Important Changes

The personnel changes of outstanding interest were the following: Lemuel A. Garrison became superintendent of Yellowstone National Park, succeeding Edmund B. Rogers, who had held that position for more than 20 years. Mr. Garrison was succeeded by John M. Davis in the important Washington Office position of chief of conservation and protection. With the move of Mr. Davis to the Washington Office, the position and office of general superintendent, Southwestern National Monuments, were abolished. The former training officer of the Service, Frank Kowski, became the first supervisor of the new training center, and was succeeded in the position of training officer by Julius E. Eittington, who, in turn, was succeeded in the position of chief, classification section, by Geneva Pillars.

Three important new superintendencies were filled for the first time. Melvin J. Weig was promoted to the position of superintendent, Edison Laboratory National Monument; Harold A. Hubler was promoted to the position of superintendent, Virgin Islands National Park and San Juan and Virgin Islands National Historic Sites; and Glen T. Bean was promoted to the position of superintendent, Bryce Canyon National Park.

Administrative Manual Revision

The revision of the National Park Service Administrative Manual, a management improvement project, has progressed well during the year. The existing volumes of the Manual are being revised in a new format and are to be reduced to five volumes. Obsolete and inappropriate material is being deleted and new or revised material incorporated to provide an effective working tool for officials and employees in the field. Of the 5-volume revision, 1 volume has been completed, 6 parts of other volumes have been published, and 25 parts are in draft form.

Plans have been approved for abolishment of the Branch of Office Services as such, and for consolidation of its functions with others in a new Branch of Property and Records Management.

Visitor Accident Fatalities

Fifty visitors died as the result of accidents in the calendar year 1956. Twenty-two resulted from motor vehicles and 20 from drowning; 30 of the 50 occurred in the age group 25 or under.

With 54,923,443 visitors the fatality rate was 0.91 per million visitors for 1956; in 1955 the rate was 1.08.

While the number of motor vehicle fatalities nationally increased sharply in the calendar year 1956, there was no increase in visitor motor vehicle fatalities in areas administered by the Service.

Employee Safety

The Service is continuing its cooperation with the Department in a program aimed at the reduction in employee injuries. Considerable work has been done in drafting a revised health and safety program, including plans for an enlarged staff to make the program effective.

NATIONAL CAPITAL PARKS

Administration

A survey of National Capital Parks was completed by the survey team appointed by the Secretary of the Interior and its recommendations are now being carried out in accordance with the instructions of the Secretary.

Physical Improvements

Significant physical improvements included the beginning of construction work for the George Washington Memorial Parkway from Spout Run to Langley, Va.; reconstruction of a portion of the Rock Creek and Potomac Parkway; new lighting for the Thomas Jefferson statue; new heating and cooling system at the Jefferson Memorial; painting the exterior of the Executive Mansion and Executive Offices; completion of Milkhouse Ford Bridge and Kalmia Bridge in Rock Creek Park; rehabilitation of Klinge Mansion for the new Rock Creek Nature Center; restoration of the Paw-Paw tunnel on the Chesapeake and Ohio Canal; and completion of landscape plantings for the Columbia Island Marina, the Great Falls parking area, East Capital Street Bridge approaches and Rock Creek parking lots at Beach Drive and Military Road.

Special Events

Some 256 public events were held, including such major civic undertakings as the National Independence Day Celebration, the President's Cup Regatta, the Christmas Pageant of Peace, and the Cherry Blossom Festival.

Visitor Services

Historical and natural history visitor services included school assembly talks; organized museum and nature center visits; and outdoor program of conducted walks, tours, and evening programs; and service band and symphony concerts at the Watergate.

Museum Acquisitions

Valuable acquisitions included engravings of the Lincoln family and the Battle of Gettysburg, given by Mrs. Dwight D. Eisenhower; and six pieces of the original parlor furniture for the Custis-Lee Mansion, on indefinite loan from Mrs. George Bolling Lee.

Research and Planning

A general development plan for Fort Washington was completed; development plans were completed for the Columbia Island Marina clubhouse, Old Stone House, and Chevy Chase Circle; development studies were made for Washington Monument Grounds; park operations building, water sports center, and the national monument on the Nevius tract.

Protection

The United States Park Police received many commendations, including a letter of praise from President Eisenhower. The Park Police cooperated with the Department of State in demonstrating police methods and techniques to visiting foreign police officials.

Land Acquisitions

Some 15 parcels of land were acquired and recorded in the land records, the major acquisition being for the George Washington Memorial Parkway in Arlington County, Virginia.

DIVISION OF AUDITS

In spite of the difficulty of recruiting auditors qualified to participate in our audit program at the grade levels authorized, the Division of Audits has made excellent progress. Major reports completed during the year cover the following Service and concession operations: Lincoln Museum and the House Where Lincoln Died, Washington, D. C.; Lehman Caves National Monument, Nevada; Statue of Liberty National Monument, New York; Mammoth Cave National Park, Kentucky; Circle Line-Statue of Liberty Ferry, Inc., Statue of Liberty National Monument, New York; and National Park Concessions, Inc., with operations on the Blue Ridge Parkway in North Carolina and Virginia and at Mammoth Cave, Big Bend, Isle Royale and Olympic National Parks in Kentucky, Texas, Michigan and Washington, respectively. The audit program and reports are designed to provide management with an objective review and appraisal of all operations on a systematic and recurring basis.

OFFICE OF TERRITORIES

Anthony T. Lausi, *Director*



DURING the fiscal year the Office of Territories has continued its historic mission of promoting political freedom, encouraging economic development, and providing essential governmental service in Alaska and in the islands of the Caribbean and the Pacific that comprise the Territories of the United States.

In two of these Territorial areas, Alaska and Hawaii, the progress of self-government has so far advanced that few political services need be provided by the Department of the Interior. That these two Territories would ultimately become States has been implicit in their relationships with the Federal Government since their establishment as Territories. That they should achieve statehood now is the firm policy of the present administration.

During the fiscal year considerable progress toward making these two Territories the 49th and 50th States of the Union has been made. President Eisenhower has proposed statehood for Alaska with national defense interests safeguarded through the power to withdraw certain areas in which the Federal Government will have jurisdiction for defense purposes. Most of Alaska, however, and all but a tiny fraction of its population, would be included within the new State. After extensive hearings in March 1957 the House Committee on Interior and Insular Affairs of the 85th Congress overwhelmingly approved an Alaska statehood bill. The next fiscal year may see Alaskan statehood finally achieved.

The administration is equally determined that Hawaii shall see its statehood aspirations fulfilled at an early date.

The Department is proud of the fact that the fiscal year brought outstanding "firsts" in high Territorial appointments. In Alaska, for the first time, an Alaska-born citizen was named governor, while in American Samoa, and also for the first time, a native-born Samoan succeeded to the governorship. It is likewise an indication of for-

ward-looking Department policies that a career employee has become High Commissioner of the Trust Territory of the Pacific Islands.

Two major Office of Territories functions in Alaska were discontinued during the fiscal year. In September 1956, the road-building and maintenance functions of the Alaska Road Commission, which had been a Department of Interior responsibility for many years, was transferred to the Bureau of Public Roads of the Department of Commerce. In February 1957, Alaska's mental health program was transferred from the Department to the Territorial government.

In all the Territories the Department continued to emphasize the importance of efficient and economical administration of the Department's Territorial functions. This policy, combined with the encouragement of sound economic development, has been thoroughly justified by events.

In the Virgin Islands it has been unnecessary, for the first time in years, to borrow money to finance current operations. The Virgin Islands Corporation has had one of its most successful years.

American Samoa has made noteworthy economic progress. Pago Pago has seen a sharp increase in its port operations. The fish cannery, sponsored by the Department and the Samoan government, as a private enterprise venture, has continued to be an unqualified success. The fiscal affairs of American Samoa are in good order.

In the Trust Territory efficient governmental administration has contributed greatly to the progress of the Islands. Local trading companies have received governmental guidance and government loans where necessary. Copra operations have been improved and the copra stabilization fund has insured to Micronesians a steady income from copra in spite of declining copra prices. Fishery operations and new agricultural activities are being promoted.

The presence of the Military on Guam is the basis of a continued prosperity which places that Island in an extremely favorable economic position. The Government of Guam has worked in close cooperation with military authorities in solving Island problems.

Boom conditions continue in Alaska. The successful pulp operation at Ketchikan has encouraged other similar use of southwestern Alaska's great forest resources. Another mill at Sitka seems certain and there are prospects for a pulp operation at Juneau. Extensive private drilling for oil is at last producing results and, as the fiscal year ended, there was at least the possibility of a major oil strike on the Kenai Peninsula.

Government services for which the Department of Interior is responsible continued to meet the twin standards of high quality and reasonable cost. The Alaska Railroad increased its commercial serv-



FIGURE 33.—A native celebration, Samoa.

ices and operated without congressional appropriations in spite of the loss of a large and profitable petroleum movement to the military Haines-Fairbanks pipeline. The Alaska public works program sponsored additional civic improvements which, over the past several years, have greatly increased the amenities of living in Alaskan towns and cities.

In American Samoa and in the Trust Territory, federally administered health, education, and public works programs have progressed to higher standards with ever greater participation on the part of Samoan and Micronesian personnel.

In all these Territorial activities the Department has been thoroughly aware of its international responsibilities. In many respects the Territories are laboratories of democracy. It is important to the position of the United States in world affairs that the world should know that our experiments in the application of democratic principles to varied peoples in far places have proved increasingly successful.

ALASKA

Statehood Progress

Alaska made substantial progress toward statehood during the 1st session of the 85th Congress.

In his budget message President Eisenhower recommended "that, subject to area limitations and other safeguards for the conduct of defense activities so vitally necessary to our national security, statehood should also be conferred on Alaska." On behalf of this administration policy the Secretary of the Interior urged the enactment of statehood legislation which would also provide adequate protection for national defense interests in northern and western Alaska.

The administration's defense proposal would authorize the President to create one or more special national defense areas over which the Federal Government would exercise exclusive jurisdiction. Legislative, executive, and judicial powers over such national defense areas would be vested in the United States and the laws of Alaska would be adopted as Federal laws. The State of Alaska, however, would retain the power to prescribe voting requirements and procedures, and the right to enforce its voting laws within the boundaries of the lands withdrawn for defense purposes.

Alaskans recognize the importance of meeting national defense requirements and virtually no objections have been raised in the Territory to the administration's proposal. The authority to be conferred upon the President, with respect to only a part of Alaska, is similar to that previously conferred upon the United States by 25 States.

The Committees on Interior and Insular Affairs of the 85th Congress have held extensive and thorough hearings on the subject of Alaskan statehood. Through 10 days of public hearings during March 1957, opportunity was given proponents and opponents to make known their views to the House Committee. By a vote of 24 to 6 the full Committee reported the bill favorably.

H. R. 7999, a substitute bill which incorporated most of the administration's recommendations, was introduced and reported favorably by the House Committee late in June. This bill provides for the approval of the draft constitution ratified by the Alaskan electorate on April 24, 1956, and substantially hastens the day when Alaska will join the Union as a State.

Alaska-Born Governor Appointed

In Juneau, on June 8, 1957, the first Alaska-born Governor of Alaska took his oath of office. Michael A. Stepovich of Fairbanks,

who is also the youngest man ever to become Governor of the Territory, succeeded B. Frank Heintzleman, who had served from April 10, 1953, to January 3, 1957. Waino E. Hendrickson of Juneau was reappointed by the President for a second 4-year term as Secretary of Alaska.

Developments in Free Enterprise

The rate of economic activity in Alaska was maintained at a high level during the fiscal year. Population continued to grow and both westward and southeastern Alaska have shared in the economic progress that has been made.

An increase in private enterprise activities in Alaska is an encouraging portent for the future. In southeastern Alaska the success of the \$56 million pulp mill at Ketchikan has been followed by other large programs for utilizing Alaska's immense forest resources. A new pulp mill at Sitka seems assured and a mill at Juneau is in prospect.

Interest in oil discovery continued high in spite of inconclusive results from current drilling. Shortly after the close of the fiscal year the Richfield Corp. brought in a well on the Kenai Peninsula. The resulting boom in oil leases saw nearly three-quarters of a million acres filed on in a single day. There is no doubt that a confirmed oil strike in Alaska will mean a tremendous stimulus to the Territory's economic growth.

Legislative Session

The 23d Territorial Legislature convened on January 28, 1957, for its regular biennial session. High among its accomplishments were the enactment of modern commitment and hospitalization provisions for the Territory's mentally ill, the passage of tax incentive legislation, and the reorganization of several of the Territory's executive agencies. The Legislature also passed a measure creating an Alaska Fish and Game Department and an Alaska Fish and Game Commission.

The enactment by the 84th Congress of the Alaska Mental Health Enabling Act, Public Law 830, was a significant step forward in the Department's policy of assisting the Territories to assume the maximum possible responsibility for their own affairs. Responsibility for the commitment and care of the Alaskan mentally ill, exercised by the Federal Government since 1900, was transferred to the Territory in accordance with the act on February 23, 1957. At the time of the transfer of responsibility, 368 patients were under care.



FIGURE 34.—Mount McKinley National Park, Alaska. “Denali” as seen from the highway.

Under previously existing Federal statutes, patients were cared for in a private hospital in Portland, Oreg., under contracts with the Secretary of the Interior. Hospitalization facilities in the Territory were nonexistent. Public Law 830 authorizes the full exercise of authority by the Territory for commitment and hospitalization of the mentally ill and provides for grants totaling \$12,500,000 for construction purposes and for carrying out a mental health program. The act also provides for a land grant of 1 million acres to assist Alaska in meeting these responsibilities. The way was thus cleared for the enactment of a modern mental health program by the Territorial Legislature.

Revision of Territorial land laws will promote better management of lands including those granted under the Mental Health Enabling Act and other land measures pending before the 85th Congress.

Enactment of the legislation creating the Fish and Game Department was marked by controversy. This legislation resulted, however, from a desire of Alaskans to participate more actively in the management and development of their natural resources. Responsibility

for Alaska's fish and game is vested in the Federal Government. While this responsibility is unchanged by the Territorial statute, the newly created Department is "to assist in the protection, research, restoration, propagation, and increase of fish and game of the Territory of Alaska."

Alaska Road Commission Transferred to Commerce

On September 16, 1956, the Alaska Road Commission, under the jurisdiction of the Department of the Interior since 1932, was transferred to the Department of Commerce in accordance with the provisions of the Federal Aid Highway Act of 1956, Public Law 627. The Commission, originally created in 1905, had built more than 3,500 miles of roads interconnecting the Territory's principal cities and military installations and serving agriculture, mining and industrial areas. Subsequent to the transfer, the Commission was reorganized as Region 10 of the Bureau of Public Roads.

Rail and Highway Commission

In early fiscal year 1957 the Congress enacted legislation creating a commission to make thorough and complete studies of the economic and military advantages and benefits of additional highway and rail routes between the United States and Alaska and to make feasibility studies of possible feeder routes from coastal ports. The final report and recommendations of the Commission are to be submitted to the Congress by August 1, 1958.

Amended by Public Law 85-16 to increase the membership to 13, Public Law 884 was implemented in June 1957 by the appointment of the 13 Commissioners by the President. The Office of Territories promptly undertook arrangements for the first meeting of the Commission while a request was initiated for \$75,000 to be appropriated to the Commission to enable it to carry out its duties. The first meeting was scheduled for July 1957.

The Alaska Railroad

Despite continued losses in oil revenue during fiscal year 1957 to the military, Haines-Fairbanks pipeline, many physical improvements were made by The Alaska Railroad to increase operational efficiency and to develop new traffic. No congressional appropriations were requested nor are any anticipated for the immediate future.

A program of administrative economies, coupled with physical improvements to the Railroad property, was instituted by the general managership which was changed in August, 1956. The administra-

tion continued the policy of selecting qualified men from the ranks of railroad management in the United States to direct The Alaska Railroad. This policy has resulted in improved service, increase in the quantity and quality of the physical assets of the Railroad, and decreased operating expenses. It should be continued.

To replace traffic lost through diversion of bulk petroleum products to the military pipeline, the Railroad further developed its trailer-on-flat-car and unit rail box service. Two major shippers, Garrison East Freight Lines and Alaska Freight Lines, are utilizing these "piggyback" services the year around because of traffic arrangements with the Railroad. Loading ramps have been constructed at Seward, Anchorage, and Fairbanks.

Sixty-five new unit rail boxes, 25 equipped with temperature control devices, were added to the 9 purchased in fiscal year 1956. The Railroad took delivery on 50 70-foot flat cars for unit rail box service and other commodity loading.

Construction by General American Transportation Co. has now started on the building of 50 roller-bearing hopper cars.

Outstanding among physical improvements was the completion of the first berth and transit shed of the Marine Terminal, Seward. Because of expected increasing efficiency in cargo handling, the Railroad called for bids on a new longshore contract at the Seward terminal. It is estimated that annual savings of \$300,000 will accrue to the Railroad as a result.

To improve Railroad communications and assist the Army-operated Alaska Communication Services, a contract was let to build a microwave system in an area where snowslides frequently take out wire circuits.

The Anchorage International Airport spur was completed in May to serve two major oil companies, the Civil Aeronautics Authority and the United States Post Office. It is anticipated that the spur will open a considerable industrial area.

An inventory of all nonexpendable property of the Railroad was started and reductions in surplus items carried in Railroad stores are being continued. A reclamation yard for the reclaiming of usable parts and the separation of scrap is now being developed in the Anchorage rail yard.

Continued work, in rehabilitating roadway, track and equipment, started in previous years is progressing satisfactorily.

A refinement of the Railroad's accounting and record systems is being completed. A considerable savings in personnel expense will accrue as a result of the increased use of I. B. M. techniques, extending to property and equipment records and the compilation of statistics. Increased emphasis has been placed also on internal auditing as a

means of assuring compliance with regulations, and evaluating practices and procedures.

Public Works Program

In 1949, by Public Law 264, the 81st Congress authorized a \$70 million program of public works in Alaska to foster economic and social development through provision of facilities for community life. This 5-year act was later extended by Congress to June 30, 1959. Under this program the Federal Government, upon application by a public body, such as the Territory, a city, a school or utility district, finances the entire cost of construction of approved projects and, upon their completion, transfers them to the public bodies for whom they are built at prices that will return to the Treasury of the United States not less than 50 percent of the total cost.

Through June 30, 1957, congressional appropriations totaling \$58,676,200 have become available. Allotments have been made in the amount of \$58,502,000 to 139 projects, including \$328,000 to 18 units for emergency relief, 52 schools, 6 hospitals, 8 municipal buildings, 36 sewer and water projects, and 19 other projects, including streets and utilities. Of these, 112 projects valued at \$41,429,267 are complete. Another 6 projects valued at \$6,258,000 are substantially complete, and 16 projects with an estimated value of \$9,512,150 are under construction. Another 5 projects, estimated to cost \$1,303,450 are in the planning stage and are expected to be under construction during the 1957 construction season.

This has been a popular program in Alaska and Alaskan citizens have been more than willing to authorize the necessary taxes to repay their share of its cost. While there remains to be appropriated only \$11,323,800 of the originally authorized \$70 million, there are pending at the present time applications for projects estimated to cost approximately \$41,170,000. The appropriation for fiscal 1958 is \$6 million.

HAWAII

Hawaii faced the challenge and the problems of a rapidly expanding economy as nearly every index of economic growth continued to show strength during 1956-57.

Reflecting the economic trend, tax collections reached record levels. Collections of Territorial general fund revenues amounted to \$101,456,377 during the 1955-57 biennium, exceeding the yields of the previous biennium under the same tax structure by more than \$10 million.

Tourism reached record proportions with every expectation of still greater growth ahead. Continued national prosperity and an aggres-

sive promotional campaign resulted in approximately 150,000 visitors spending 2 or more days in Hawaii during the fiscal year. Visitor expenditures were in the neighborhood of \$73 million. New Waikiki beach hotels give striking evidence of this expansion.

Military activity and expenditures, from which the Hawaiian economy derives a substantial income, continued to increase. On July 1, 1957, Hawaii became the command headquarters of all United States Armed Forces in the Pacific and the Far East.

Production in the basic agricultural industries of sugar and pineapple growing continued to show improvement.

Industrial-commercial construction showed a sharp upturn during the last 6 months of the fiscal year. Construction of dwellings also increased. However, a housing shortage exists which has been aggravated by the influx of additional military personnel. Unemployment declined during the year while both the size of the labor force and the number employed showed an increase.

The increasing pace of economic activity has been accompanied by a growing demand for governmental services. The pressure for more spending to meet these needs, especially in education, has been partially offset by economy measures adopted by other Territorial agencies. Public works of major importance, particularly in highway construction, and water supply improvement, were undertaken. New farm and homesteading acreage have been opened up under the auspices of the Hawaiian Irrigation Authority. The long planned Molokai irrigation project, when completed, will provide water to irrigate about 14,000 acres, nearly all of it pineapple land. Other irrigation projects are under consideration.

Enrollment in the public schools, which has increased by an average of 5,000 pupils annually, reached an all-time high of nearly 125,000 as of December 1956. The problem of providing adequate classrooms remains acute.

The challenge of creating new jobs continued to be a major problem. Economic planning is receiving concentrated attention, with emphasis on the development of new export industries and local production to replace as many imported items as practicable.

Hawaii continues to be one of the healthiest places in the world, according to its public health record.

TRUST TERRITORY OF THE PACIFIC ISLANDS

During the 12 months under review, the administration of the Trust Territory continued to advance its many programs for assisting the Micronesian people to attain higher living standards and a greater degree of political and economic self-sufficiency.

Growth in Self Government

The establishment of basic plans for the incorporation of municipalities, and the completion of the chartering of district congresses, constituted the major effort of the year in advancing the art of government. The granting of formal charters to congresses and municipalities is now under way. During the year a conference at Guam of Micronesian leaders, chosen by local district congresses or similar groups, contributed to a broader understanding of the political problems of the Islands. Another conference at Trust Territory headquarters brought together the Micronesian officials of the nine chartered trading companies. These companies were assisted in putting their affairs on a sound financial basis by a Trust Territory staff auditor and two of them were granted new loans during the year. All stock in the major trading companies is Micronesian-owned, and distribution is widespread.

A tax survey of the Territory was made and the resulting recommendations were studied to determine which revisions in the Territory's tax structure would be advisable.

Other developments included a revision in the allotment structure of the government to permit the preparation of cost-based budgets. Under the direction of the chief justice a judiciary conference was held at Guam with Micronesian judiciary representatives present. The Deputy High Commissioner was advanced to the post of High Commissioner and a new Deputy High Commissioner was appointed. Two top district administrative positions, which were formerly filled by American staff members, were assumed by Micronesians.

Economic Efforts Intensified

Sales of copra, the chief commodity of the Trust Territory, increased slightly over the preceding year. Almost 13,000 tons were sold for a revenue return of approximately \$1,400,000 to the Micronesians. In a declining world market copra income to islanders was maintained at a steady level through the copra stabilization fund.

Improvement in agricultural practices, particularly with respect to coconuts, was achieved. A specialist in coconut operations carried on extensive work among the islands and thousands of new plantings were made. An improved type of dryer for coconut meat was introduced which resulted in a spectacular improvement in copra quality where put to use.

Similar activity was carried on with respect to trochus shells. The marine biologist made a survey of trochus habits and availability in Trust Territory waters, and offered recommendations for conservation. Although trochus shell volume was down from the preceding years,

the higher market price produced a return of \$388,888 which is \$38,000 more than during the previous year. Extensive research was performed on a major project to begin in July 1957 for the planting of live trochus in suitable locations among the islands as nuclei for future harvestings.

Further development in both agriculture and fisheries is expected to come as a result of the return of Micronesian students from abroad. Two special programs were arranged for trainees in cocoa and fishing. In all districts, staff agriculturists are conducting extension services as well as maintaining agricultural centers and field nurseries. An appreciable increase in the production of vegetable produce has resulted. The upgrading of livestock is being accomplished through the introduction of purebred animals.

Education and Public Health

Emphasis in education is being placed on the training of Micronesian teachers and the development of a basic curriculum adapted to the needs of the students. More effort was devoted to the teaching of English as a second language. Local community support of education climbed steadily in the past year. Increasingly, Micronesians are becoming qualified for responsibility in the school systems.

The Pacific Island Central School became a full 3-year secondary school, the only Government-operated school of this level in the Territory. Construction of new buildings for the school is under way in Ponape District. This new location will offer greatly improved facilities for agriculture and other vocational training in addition to regular scholastic courses. Work was also started on a new public intermediate school at Kusaie in the Ponape District. A number of elementary schools were built or rebuilt.

In its public health program the Territory began a B. C. G. vaccination program in the fight against tuberculosis and is thus among the first to use B. C. G. on a wide scale as an aid in tuberculosis prevention.

Four students departed for training at the Central Medical School at Suva, Fiji, and two graduates of the school assumed posts as medical practitioners in their respective home districts. Others are studying in the field of public health in Hawaii. Advanced training continues to be given Trust Territory dental practitioners by the United States Navy at Guam.

The school of nursing at Palau increased its enrollment. A series of textbooks for Micronesian student nurses were written and published. A school of sanitation was conducted in one district, with sanitarian trainees from all districts in attendance.

Land Compensation and Resettlement

The long-pending problem of compensation to the people of Bikini and Eniwetok for use rights to their islands was finally settled and payments made. Other land settlements are in process. A long-standing property claim by a Belgian family was settled and additional public domain lands were released for homesteading.

An event anticipated for several years took place in June 1957, when 250 inhabitants of Rongelap Atoll in the Marshalls were transported to their home atoll, after living at Ejit Island for 3 years following an accidental radioactive fallout at Rongelap. The move was made in co-operation with the United States Navy and the Atomic Energy Commission. Construction of a new village, including the building of homes and the planting of crops, was completed prior to the move at the expense of the Atomic Energy Commission.

GUAM

In October 1956, Richard Barrett Lowe was appointed Governor of Guam by the President after having served 3 years as Governor of American Samoa.

Several local residents have been appointed to positions in the Government of Guam formerly held by off-island contract employees. These include three department heads and the dean of the Territorial College. This is in keeping with the policy of placing qualified persons of Guamanian ancestry in responsible government positions.

During the year a team from the United States Public Health Service completed a survey of the Guam Medical Service Department.

New Legislature Meets

A general election was held in November for members of the 4th Guam Legislature, and for Municipal Commissioners. Out of 13,000 eligible voters there were 9,499 registered, of which 83.5 percent voted during the election. The November election won for the Popular Party all 21 members of the unicameral Legislative Body.

Seventy-one pieces of legislation were passed and approved during fiscal year 1957. Of major significance was an act to supply free text books for use in the public elementary and secondary schools of Guam, and an act to encourage the education and training of resident citizens and the utilization of these citizens in government service.

Other legislation passed and approved during the year included:

a zoning ordinance for Agana, an agriculture code, a health and sanitation code, an act establishing a public employment office, and an acceptance act making Guam eligible to receive grants-in-aid under the Federal Vocational Education Act.

High School Accredited

Three hundred and thirty-six boys and girls completed their high school education in the public schools of Guam during the past fiscal year. This was the largest class ever to graduate from George Washington High School. Another significant step in Guam's educational progress was the accreditation of the high school by the North Central Association in May 1957.

Public Works

During the past 12-month period, the work accomplished on capital improvement projects by the Department of Public Works represented a total expenditure of approximately \$1,554,332. Major projects completed during the year were the new Guam Memorial Hospital, Merizo Pier, Price School, George Washington High School Cafeteria, Inarajan Junior High School, two recreation centers, additional street paving, improved area drainage, and additional government employee housing consisting of eight houses and a 20-unit apartment.

Plans for the construction of three elementary schools were also completed, which enabled the Territory to receive a United States Federal school construction grant for federally affected areas.

During fiscal year 1957 the commercial port handled 196,843 revenue tons valued at \$33,308,230. From the excess revenue which has accumulated for several years at the port, the sum of \$250,000 was transferred to the general fund to be used for additional capital improvements.

Additional appropriations were approved for continuing capital improvement projects which include highway construction and paving, improvement of parks, monuments, and the museum, construction of permanent school plants and purchases of collateral equipment, extension of power and water distribution lines, development of plans for construction of an administration building and a Territorial college, and construction and development of facilities at Paseo de Susana, the island's center for athletic and other recreational activities.

Expansion in Utilities

The public utility agency continued to expand its services throughout the Territory. During the year a major electrification project was completed providing electricity to two population centers in the southern sector of the island (Merizo and Umatac). By the close of the fiscal year, the extension of power and water services to the more populated sections of the island is well over 75 percent complete. It was also during the fiscal year that additional extensions were made in the telephone system. By June 30, 1957, over 800 homes and business establishments were connected to the telephone system, with 300 of these connections installed during the fiscal year.

AMERICAN SAMOA

The appointment of the first Samoan-born Governor in the history of American Samoa was made on October 15, 1956. The appointment was well received by the Samoan leaders and people.

Advances in Self-Government

In order to help the Legislature of American Samoa become familiar with the operations and practices of governmental systems elsewhere, a group of five members of the Legislature traveled to Honolulu in May 1957, to observe the Hawaiian Legislature in session. The operations of other government departments in Hawaii were also observed. This visit was of great value to the Legislature.

In its deliberations during a 2-week session in June 1957, the Legislature passed 46 resolutions on a variety of subjects. There is no doubt that, during the year, the Legislature of American Samoa has grown both in stature and prestige.

The participation of local leaders in the consideration and solution of policy problems was continuously sought by the administration and an increasing knowledge and appreciation of governmental affairs and responsibilities amongst Samoan leaders was evident. Visits to the districts, counties, and villages by the Governor, the Secretary, and department heads, and the discussion of problems at the village level during such visits contributed to this increasing participation in governmental affairs.

Signs of Increasing Prosperity

Economic activity continued at a relatively high rate. Employment, gross income, retail trade, and exports and imports increased. The fish cannery may now be considered a permanent Territorial in-

dustry. Many modern improvements and additions were made to the plant during the year.

Pago Pago continues to be a busy port. A total of 603 ships was cleared during the fiscal year 1957, as compared to 450 ships in 1956, and 279 ships in 1954. These figures do not include local interisland traffic between the islands of American Samoa nor vessels engaged in fishing for the cannery.

The visits of two Matson luxury liners every 3 weeks, with over 300 passengers on each vessel, and frequent visits of Navy ships have provided the territory with a considerable increase in income.

Letters of credit, loan applications and collections also continued to increase. As a further indication of the scope of business activity, the Territory had an excess of currency beyond its needs, for the first time under the administration of the Department of the Interior.

Preliminary engineering plans and testing of equipment, and final cost estimates for construction of the new commercial airstrip at Tafuna were almost completed at the close of the year. Fifty-five pieces of surplus heavy equipment were transferred from the Navy Department to the Government of American Samoa and were received in January 1957.

A drought during the first 6 months of the year placed a severe drain on food production for local consumption. As a consequence, planters are being advised to devote more attention to subsistence crops. The drought also handicapped industrial production. To assist the Territory in locating additional sources of water, the Geological Survey sent two technicians to American Samoa. Plans were being made to continue their water survey work during the fiscal year 1958.

THE VIRGIN ISLANDS

The most striking gain for the Virgin Islands in fiscal year 1957 has been the improvement in the fiscal position of the Virgin Island Government.

Revenues amounted to \$3,690,539.29, an excess of \$736,539.29 over estimates and an increase over fiscal year 1956 of \$778,764.21. Principal gains were reflected in income tax, real property tax, customs duties, and trade and excise taxes. The cash balance in the general fund of the Treasury on June 30, 1957, amounted to \$1,193,846.32, sufficient to cover all known outstanding obligations at the close of the fiscal year. For the first time in years, it was not necessary to borrow funds to finance the operations for the current fiscal year. Estimated returns from matching funds for fiscal 1957 should exceed \$3 million.

Preliminary statistics on tourist travel indicate a gratifying increase in both visitors and total tourist expenditures over the previous year. Air traffic showed a large gain and over 50 cruise ships called at the islands. The islands again played host to thousands of servicemen. Six new hotel establishments opened or were reactivated during the year. The Virgin Islands carried out a tourist promotional campaign through newspaper and magazine advertising and an increased distribution of travel literature.

The Waterfront Highway in St. Thomas was completed at a cost of approximately \$500,000. An extensive highway program in St. Croix was started and most roads in the three islands received fair maintenance. Two large schools were under construction in St. Croix, and the reconstruction of the Marine barracks building was completed for occupancy by various governmental agencies.

Water Shortage Problems Met

The greatest problem during the year was the water shortage in St. Thomas due to an unusually severe drought which began in November 1956 and was still continuing at the close of the fiscal year. Only 27.76 inches of rain fell during the year. This was 20 inches less than the previous year and 17 inches below the annual average. It was necessary to haul from Puerto Rico over 33 million gallons of water by Navy and commercial barge and by the Virgin Island's own barge.

Health, Education, and Welfare

Organization of the medical staffs in the two insular hospitals, a step toward accreditation, was completed. The polio vaccination program for children of school age attained its peak and an adult polio vaccination program was launched during May of 1957. The Health Department participated in the First Caribbean Conference on Mental Health held at Aruba, N. W. I. The Virgin Islands Commissioner of Health, was named chairman of the committee to draft plans for a Caribbean Federation of Mental Health.

Approximately 6,000 children attended public schools and 2,390 were enrolled in private schools during the year. A Board of Vocational Education was appointed and the vocational rehabilitation program began operation in March 1957. The Bureau of Libraries met requirements for participation in the Federal library service program. A Youth Center was opened in Cruz Bay, St. John, through the efforts of the Youth Commission. In the teacher-training program seven courses were offered in the 1956 summer session of the Virgin

Islands Experimental College and three courses during the school year.

The Virgin Islands benefitted from new Federal legislation which increased Federal participation in Virgin Islands social welfare assistance programs. Matching funds were provided for parents of dependent children and the annual limitation on overall Federal participation was increased from \$160,000 to \$200,000.

Other Departments Show Progress

The Department of Public Safety initiated an in-service training program for the men in the Police Division under the direction and supervision of the Federal Bureau of Investigation. Two-way radio communication linking the islands of St. Thomas, St. Croix, and St. John and radio equipped motorized units were installed. A centralized record bureau, a unified interisland traffic program and a unified criminal investigation bureau under the supervision of the insular chief of detectives were being perfected.

The Department of Agriculture and Labor promoted increased cooperation between producers, distributors, and consumers of food products. It also conducted a program for the vaccination of hogs, which resulted in the control and near eradication of hog cholera and, in cooperation with the Federal Government, started a program for the control of brucellosis.

VIRGIN ISLANDS CORPORATION

The Virgin Islands Corporation was established to develop the economy of the Virgin Islands and was chartered for a period of 10 years beginning July 1, 1949. Its principal operations include the production and manufacture of raw sugar, the generation and distribution of electric power, and the conduct of a loan program and various agricultural development projects.

The 1957 sugarcane crop was the most successful in the history of the Corporation. As a result the Corporation showed a profit for the first time; the amount \$215,544. The sugar operation, as a whole, showed a profit amounting to \$78,048. A total of 132,415 tons of sugarcane were ground and 14,789 tons of 96° raw sugar were manufactured. Facilities for the handling and storage of bulk sugar were installed during the year and it is expected that this changeover will result in substantial savings in shipping costs.

The sale and distribution of electric power has increased approximately 20 percent over the past 4 years. A project to provide power to the Island of St. John was completed during the year with the in-

stallation of a submarine cable between St. Thomas and St. John.


Under the soil and water conservation program, 13 earth dams, 2 in St. Thomas and 11 in St. Croix were constructed. A total of 780 acres of land were cleared on St. Croix under the land clearance program. These two programs have contributed substantially to the overall agricultural development of the islands. The dam program in particular has been outstandingly successful. Over 3,500 mahogany seedlings and some 9,000 teak trees were planted on public and private lands during the year. A sawmill was set up for the processing of timber, particularly mahogany, and a large number of trees blown down in the 1956 hurricane were cut. It is expected that the wood products obtained will be utilized in the development of local industries.

The operation of the properties located on St. Thomas, formerly utilized by the Navy and presently assigned to the Secretary of the Interior from the Navy under a use permit, has continued most successfully. Income from these properties increased substantially over the previous year. The funds derived are utilized for operating expenses and for maintaining the properties in good condition.

Office of the Assistant Secretary

Fish and Wildlife

Ross L. Leffler, *Assistant Secretary*



THE ASSISTANT SECRETARY for Fish and Wildlife discharges the duties of the Secretary with respect to the Department's programs in the field of fish and wildlife. He is responsible for the secretarial supervision and direction of the United States Fish and Wildlife Service under the Commissioner of Fish and Wildlife and its Bureau of Sport Fisheries and Wildlife and Bureau of Commercial Fisheries.

Two significant developments to have great impact on Federal activities in fish, shellfish, and wildlife resource management took place during the past year. The first was the reorganization of the Service under the Fish and Wildlife Act of 1956 and the second was the initiation of a sweeping planning effort for a vigorous, new 10-year program for fish and wildlife.

The Fish and Wildlife Act created the position of Assistant Secretary for Fish and Wildlife and the post of Commissioner of Fish and Wildlife. It also established the United States Fish and Wildlife Service consisting of two agencies with bureau status—the Bureau of Commercial Fisheries, responsible for matters relating primarily to commercial fisheries, whales, seals, and sea-lions, and the Bureau of Sport Fisheries and Wildlife, responsible for matters relating primarily to migratory birds, game management, wildlife refuges, sport fisheries, sea mammals (except whales, seals, and sea-lions). Reorganization took effect on November 6, 1956, and its implementation through the appointments of personnel to head the new bureaus and fill supporting staff roles has been a continuing process.

A task force in both Commercial Fisheries and Sport Fisheries and Wildlife, composed of staff members from central office and the field, was established and early in 1957 began to review the needs and de-

velop projects to meet them in these important areas of natural resource management. Service personnel, as well as State and private agencies dealing with commercial and sport fisheries and wildlife, were canvassed for suggestions. As the fiscal year ended, the new program was nearing final form for submission to the Secretary.

In the field of waterfowl management, the year was one of productive effort. The development of flyway management plans was initiated as a partnership effort of the Service and the State fish and game departments through the Flyway Councils. The plans will spell out research and management activities which are needed, including acquisition and development of key areas. The preservation of 12 million acres in a basic network of strategically distributed wetlands is held necessary to perpetuate the waterfowl resource. Long ago, a goal of 7,500,000 acres of lands for waterfowl in Federal ownership and management was established. There are now 3,270,000 acres in the 205 Federal waterfowl refuges. Accelerated destruction of wetlands in the past 20-odd years emphasizes the need for stepping up this acquisition program.

In the field of wildlife research, increased attention is being given to the use of pesticides to determine their effects on wildlife and how that can be minimized. There was progress also in correlating mosquito control with waterfowl habitat improvement work. Investigations into ways to reduce blackbird depredations were equally accelerated.

The Federal aid in wildlife and fisheries restoration continued to produce effective research and management programs in the States and the Territories.

To help management maintain fishery populations in waters where natural production cannot keep pace with mounting angling pressure, funds for the construction of six hatcheries were secured from the Congress. Trout production from existing hatcheries also was increased. Under reorganization, plans for expanded fishery management field services were developed.

Water development projects either conducted by, or with financial assistance or under license of the Federal Government continued to receive the careful examination of the Service to determine their effects on fish and wildlife. A total of 340 such reports were issued. Efforts to amend the Coordination Act of 1946 to provide for enhancement of fish and wildlife values in such projects instead of just mitigation of damages also were initiated, and the governors of the 48 States endorsed this action.

Predator and rodent control activities involved an intensified effort to evaluate new rodenticides, repellents and scare devices, leading to the improvement of techniques for keeping troublesome wildlife populations in check.

In the commercial fisheries field, the Fish and Wildlife Act of 1956 triggered a number of important advances. Fishermen in the industry were given substantial financial assistance through a \$10 million loan fund which the act established. Loans for financing and refinancing of operations, replacement, repair and maintenance of gear and vessels, and for research into fisheries problems are provided. Before the end of the year, applications had crossed the 10 million mark.

The act also made permanent the Saltonstall-Kennedy program which makes available 30 percent of customs duties on fishery products imports to underwrite research and services to improve markets for domestic fishery products. These activities were greatly stimulated.

Another important advance was in the development of voluntary United States standards for fishery products. Standards for frozen fried fish sticks became effective and several other standards were in process of development. Commercial utilization also was developed for a deep-water royal-red shrimp found by one of the Bureau's exploratory fishing vessels off the southwestern coast. As a result of another of these studies, a new shrimp fishery also has been developed off the State of Washington.

In the market development program, 244 fish-cookery demonstrations were given school lunchroom, institutional and other groups and two new motion pictures were finished and placed in circulation. Expansion of market news coverage also was initiated to improve this service for the industry.

Signs of progress in the restoration of Alaska's salmon fisheries as a result of the measures taken by the Bureau also were noted. Production of canned salmon rose and at the same time there were improved escapements of salmon to spawning streams. Research efforts in this important fishery received greater emphasis to provide the answers needed for pressing management questions.

In the international fishery field, where the United States is a member of a number of commissions, it was also a year of progress. Advances were recorded in the North Pacific salmon studies, through new regulations for the New England haddock fishery, and in the tuna investigations. The lamprey control program in the Great Lakes also was improved.



FISH AND WILDLIFE SERVICE

Arnie J. Suomela, *Commissioner of Fish and Wildlife*



THE LAST fiscal year has been a period of extensive reorganization. On August 8, 1956, the President approved the Fish and Wildlife Act of 1956, Public Law 1024 of the 84th Congress. This law provided that the United States Fish and Wildlife Service should be established, to replace the former Fish and Wildlife Service, and that it should consist of two Bureaus, a Bureau of Sport Fisheries and Wildlife and a Bureau of Commercial Fisheries. It provided also that the new Service should be administered under a Commissioner of Fish and Wildlife, subject to the supervision of an Assistant Secretary for Fish and Wildlife.

The Secretary of the Interior, on November 3, 1956, declared the reorganization effective as of the close of business November 5, and designated John L. Farley (previously Director of the Fish and Wildlife Service) as Acting Director, Bureau of Sport Fisheries and Wildlife, and Arnie J. Suomela (previously Associate Director of the Fish and Wildlife Service) as Acting Director, Bureau of Commercial Fisheries. Pending the appointment of a Commissioner and an Assistant Secretary, the two Bureau chiefs reported directly to the Secretary. Mr. Farley resigned as Acting Director, effective February 8, 1957, and Robert H. Johnson was designated Acting Director, February 11.

On January 2, 1957, Ross L. Leffler entered on duty as Assistant Secretary for Fish and Wildlife (appointment confirmed by the Senate, February 11). On February 15, announcement was made of the general composition of the new Service and its two Bureaus as follows:

The Office of the Commissioner of Fish and Wildlife, with his immediate staff and the Offices of Information, International Relations, and Program Review.

The Bureau of Commercial Fisheries, with the Office of the Director, an Office of Loans and Grants, and four Divisions: Admin-

istration, Biological Research, Industrial Research and Services, and Resource Management. Its field organization consists of four regional offices in the continental United States and one in Alaska under Regional Directors, a Pacific Oceanic Fisheries Investigation Office in Hawaii, and approximately 80 subordinate field installations.

The Bureau of Sport Fisheries and Wildlife, with the Office of the Director and four divisions: Administration, Sport Fisheries, Technical Services, and Wildlife. The field organization consists of five regional offices in the continental United States and one in Alaska under Regional Directors, and approximately 500 subordinate field installations.

On February 18, Arnie J. Suomela was nominated Commissioner of Fish and Wildlife (appointment confirmed by the Senate, March 29). On March 14, Daniel H. Janzen was designated as Director, Bureau of Sport Fisheries and Wildlife. On April 25, Donald L. McKernan was designated as Director, Bureau of Commercial Fisheries. On June 2, the former regional offices of the Fish and Wildlife Service became regional offices of the Bureau of Sport Fisheries and Wildlife. Action is now proceeding to establish regional offices of the Bureau of Commercial Fisheries.

In the following summaries of the year's operations, activities have been grouped generally under the Bureau in which they will continue, although the distribution of functions has been a progressive one throughout this period of reorganization.

BUREAU OF SPORT FISHERIES AND WILDLIFE

Daniel H. Janzen, *Director*



COOPERATION IN WILDLIFE REFUGE MANAGEMENT

THE national wildlife refuge program continued to provide major benefit to the migratory waterfowl resource of the North American Continent. This program embodies three basic objectives: The protection of migratory birds, leading always to the annual provision of an adequate residual broodstock to perpetuate the resource; the preservation through Federal ownership of a basic segment of the overall waterfowl breeding, intermediate, and wintering habitat; and the protection and preservation of indigenous species of birds, mammals, and other wildlife and their habitat.

Intensive use by millions of ducks and geese on most refuges along the four flyways provides proof that these areas are enabling the Bureau to carry out responsibilities under the migratory-bird treaties with Canada and Mexico.

Despite all that has been done over the years, the needs of waterfowl are in ever-growing competition with the requirements of an expanding human population. The draining of marshes for agricultural improvement, and for metropolitan and community growth, poses problems that will be most difficult to solve. For years past we have watched marshes and ponds disappear as agriculture has expanded, particularly in the prairie-pothole region of Minnesota and North and South Dakota. These areas were the most productive waterfowl lands in the United States, fully equal to the best producing areas in Canada.

Similar drainage is occurring in many coastal sections, which are most important to the birds as wintering grounds. Most of the great natural marshes of the Gulf are being ruined or seriously

damaged for waterfowl use by salt-water intrusion as a result of the intracoastal and connecting canals, and by exploration for sulfur and oil.

Waterfowl of the Pacific flyway are rapidly approaching a crisis because the lush marshes which once supported myriads of birds wintering in California and northern Mexico are being turned into cotton and rice fields, orchards, and urban developments.

Thus we see waterfowl facing a precarious and uncertain future, and in years to come increasing reliance will probably have to be on lands dedicated to their needs—lands in the ownership of the Federal Government and the States, or in the ownership of people with a love of wildlife. At the same time, acquisition of such lands will increasingly be in competition with other human uses, and therefore only at competitive prices. The need for an accelerated acquisition and development program faces us now.

FIGURE 35.—Some 273 national wildlife refuges provide 17,361,141 acres of habitat for American migratory birds and other animals. Thousands of snow and white-fronted geese like these are to be found at Sacramento National Wildlife Refuge each year.



In 1934 a careful study of our waterfowl resource showed that originally we had approximately 120 million acres of marsh and wetlands. Fewer than 30 million acres of habitat of good quality for waterfowl remain today. In 1934, on the basis of the existing waterfowl population and future requirements of the waterfowl resource, it was felt that the Federal Government should own and develop 7,500,000 acres. That estimate has stood the test of time. We are almost halfway to that goal now with 205 waterfowl refuge areas, totaling 3,270,000 acres.

We still need about 4 million acres, and we need them very soon because of the greatly accelerated destruction of waterfowl habitat and the great increase in the number of waterfowl hunters.

During fiscal year 1957 long-range development plans were prepared by each of the refuge managers. Summaries of these projects, by priorities, have been prepared for an accelerated development program over a 10-year period. This program covers not only the development on the 205 waterfowl refuges but also on big-game areas, wildlife monuments to protect endangered species, and on other lands needed to insure future waterfowl needs.

The United States Air Force and the United States Fish and Wildlife Service signed an agreement establishing an Air Force-wide fish and game conservation program. Many air bases in the United States and its Territories are located on vast reservations where fish and game are plentiful. With the program as now planned, the Air Force hopes to join with local, State, and Federal conservation organizations in the protection and control of wildlife. This Bureau is aiding the Air Force by providing, within the limits of available funds and personnel, technical assistance in preparing fish and wildlife development and management plans, and related services.

The United States Department of the Navy, desiring to establish a Navy and United States Marine-wide program to manage renewable resources on all lands under their control, created an advisory group of civilian specialists for guidance and counsel.

Agreement was reached with the Bureau of Land Management which offers a solution to the problem of preserving the Alaska brown bear. A cooperative agreement entered into this year between the Bureau of Indian Affairs, Bureau of Land Management, and this Bureau will result in proper management of the Alaskan reindeer resources in the wild.

Over a 5-year period personnel on the 116,000-acre White River National Wildlife Refuge in east-central Arkansas endeavored to secure cooperative agreements with the four Soil Conservation Districts in which the refuge is located. At a meeting this year, with all districts represented, a cooperative forestry management program on the

White River Refuge was outlined. The various Boards not only endorsed the program but urged additional operating funds to further the conservation program. Agreements between Soil Conservation Districts and National Wildlife Refuges have now been completed on 61 areas.

TABLE 1—*Acreage acquired or in process of acquisition by Fish and Wildlife Service for wildlife conservation purposes*

| State and refuge ¹ | Acquired in fiscal year 1957 | | | Pending title conveyance |
|---|------------------------------|-------------|---------|--------------------------|
| | By other than purchase | By purchase | Total | |
| California: Salton Sea..... | | 3 | 3 | |
| Colorado: Monte Vista..... | | 1, 291 | 1, 291 | 4, 029 |
| Florida: | | | | |
| National Key Deer Refuge..... | 1 | | 1 | |
| St. Marks..... | | | | 1, 649 |
| Sanibel..... | 474 | | 474 | |
| Georgia: | | | | |
| Okefenokee..... | | | | 1, 799 |
| Piedmont..... | | 398 | 398 | |
| Illinois: Upper Mississippi River..... | 288 | | 288 | |
| Kansas: Quivira..... | | 2, 184 | 2, 184 | 1, 916 |
| Kentucky: | | | | |
| Kentucky Woodlands..... | | | | 236 |
| Reelfoot..... | | | | 79 |
| Louisiana: Catahoula..... | | | | 5, 199 |
| Maine: Moosehorn..... | | 1 | 1 | |
| Maryland: Martin..... | | | | 1, 377 |
| Michigan: Shiawassee..... | | 232 | 232 | 207 |
| Minnesota: | | | | |
| Rice Lake..... | | | | 56 |
| Tamarac..... | | | | 1, 032 |
| Upper Mississippi River..... | | 37 | 37 | 356 |
| Mississippi: Noxubee..... | | 898 | 898 | 3 |
| New Jersey: Brigantine..... | | 40 | 40 | 8 |
| New Mexico: Bitter Lake..... | | 240 | 240 | |
| New York: | | | | |
| Elizabeth Alexandria Morton..... | 75 | | 75 | |
| Wertheim..... | | | | 8 |
| North Dakota: | | | | |
| Chase Lake..... | | | | 1, 349 |
| Long Lake..... | | | | 160 |
| Lower Souris..... | | 40 | 40 | |
| Tewaukon..... | | 240 | 240 | 1 |
| Oklahoma: Tishomingo..... | 3, 170 | | 3, 170 | |
| Oregon: | | | | |
| Malheur..... | | 1, 489 | 1, 489 | |
| McKay Creek..... | 24 | | 24 | 36 |
| South Carolina: | | | | |
| Cape Romain..... | 51 | | 51 | |
| Santee..... | | 202 | 202 | 3, 034 |
| Texas: Laguna Atascosa..... | | 961 | 961 | |
| Vermont: Missisquoi..... | | 617 | 617 | 11 |
| Washington: | | | | |
| Columbia..... | | 807 | 807 | 1, 404 |
| Willapa..... | | 410 | 410 | |
| Wisconsin: Upper Mississippi River..... | 21 | | 21 | |
| Total..... | 4, 104 | 10, 090 | 14, 194 | 23, 949 |

¹ Name includes "National Wildlife Refuge" except as indicated.

TABLE 2.—*Acreage of public domain reserved for wildlife conservation purposes and administered by the States*

| State and unit | Acres |
|---|-------|
| Idaho: Carey Lake Migratory Bird Management Area..... | 320 |

The continued use of National Wildlife Refuges for recreational purposes in 1956 increased about 8 percent. Of the 7½ million visitors to these areas last year, about 2,765,000 enjoyed sport fishing. Some type of hunting, including archery, was provided on 71 refuges for 435,000. Picnicking, swimming, boating, photography, and nature study were the principal categories into which the remaining 4,355,000 were classified. On certain refuges, such as Aransas and Santa Ana in Texas, all of the visitors were attracted by the opportunities afforded for wildlife observations. Many of the 15,000 visitors on Aransas made use of the new observation tower in order to see whooping cranes near at hand.

GAME MANAGEMENT

Phases of management which concern the regulation of the harvest continue to be of particular concern. There has never been a time in the history of this country when regulation of human behavior was more important to the preservation of our migratory game bird heritage. The Bureau has been particularly cognizant of the need for careful analysis of data concerning hunter movements as well as population numbers, production, distribution, and harvest of migratory game birds.

The development of regulations embraces a multiplicity of problems. It is necessary to consider carefully not only the data obtained from breeding-ground surveys, wintering surveys, and harvest surveys, but also the distribution of the birds throughout the migration pattern. The relation of distribution to hunter activity and movement is becoming more and more important as management becomes more intensive. Public relations and cooperation with State game departments and private conservation organizations are commanding more attention. The fields of enforcement and of control of depredations by migratory game birds have broadened in scope, and the personnel have broadened their activities correspondingly.

There has been a continuing emphasis on an extensive law-enforcement program. An effective and essential tool of management, this program is carried out in close cooperation with enforcement personnel of State game departments and other agencies. Among cases prosecuted during the year were those of 53 market hunters charged in Federal courts of Texas with unlawful possession and sale of migratory waterfowl. Penalties imposed in these cases ranged from fines of \$500 and imprisonment for 6 months to fines of \$50 in the case of two youths who were accomplices of an adult offender. Ten defendants were placed on probation for 3 years, and two for 2 years, and forbidden to hunt migratory game birds while on probation. These

cases and a comparable number successfully prosecuted shortly before the close of the preceding fiscal year resulted from a 2-year undercover operation along the Texas coast (a major wintering area for ducks and geese). Its beneficial effects were evidenced during the 1956-57 hunting season by much better compliance with Migratory Bird Treaty Act regulations in that area.

Agents individually and in cooperation with State law-enforcement officers apprehended 4,790 persons who were charged in State courts with various violations of State game and fish laws. Of these cases 2,788 involved unlawful taking or possession of migratory birds and unlawful interstate transportation of birds, mammals, and fish. Many of these cases involved violation of both State and Federal laws. Fines in the cases disposed of in the State courts aggregated \$170,067 (of which \$6,627 was suspended) and jail sentences totaled 1,739 days (of which 1,326 days were suspended).

During the year, 250 cases involving violations of the Alaska Game Law were terminated. In addition there were four convictions in Alaska for violations of the Migratory Bird Treaty Act and three for violations of the Migratory Bird Hunting Stamp Act. Fines aggregated \$21,718 (of which \$3,576 was suspended) and jail sentences totaled 2,030 days (of which 870 were suspended). Forfeitures resulting from violations of the Alaska Game Law included 36 firearms, 156 licenses, 87 furs, 47 big-game animals, 1 walrus head, and 25 game and nongame birds. In all types of cases handled by Bureau agents during the year, the rate of conviction was approximately 99 percent.

Modern transportation equipment such as marsh buggies, airthrust boats, aircraft, 4-wheel drive vehicles, and amphibious craft have added to the difficulties of game-law enforcement by opening up hunting areas that were formerly remote and difficult of access. By use of like equipment and by ingenuity and resourcefulness, Bureau enforcement agents have succeeded in bringing law to such areas. High-power spotting scopes have been provided agents, enabling them to make observations over a wide area and at comparatively long ranges. Two-way portable radio equipment is being used to very good advantage and is one of the best means of coordinating patrol activity and making most effective use of available manpower.

In gathering data for use in formulation of regulations, Bureau personnel conducted extensive waterfowl breeding surveys and banding projects in collaboration with State and Provincial game departments, the Canadian Wildlife Service, Ducks Unlimited, and the Wildlife Management Institute.

With the exception of Mexico, the midwinter waterfowl population survey was again carried out, as were the post office hunter kill survey and a limited winter banding program.

Particular consideration was given this year to the development of flyway management plans for waterfowl. Discussions on these management plans were held at meetings of flyway councils at the same time as discussions of the migratory bird regulations. These meetings were particularly helpful in developing better public understanding of regulatory problems.

TABLE 3.—*Cases disposed of in Federal courts (exclusive of Alaska) involving violations of wildlife conservation laws administered by the Bureau of Sport Fisheries and Wildlife, fiscal year 1957*

| | Pending July 1, 1956 | New cases | Pending June 30, 1957 | Terminated | Fines and costs | Jail sentences (days) |
|---------------------------------------|----------------------------|--------------|-----------------------------|------------|-----------------------|--------------------------|
| Migratory Bird Treaty Act..... | 532 | 743 | 417 | 853 | \$48,452 | 1,570 |
| Migratory Bird Conservation Act..... | 48 | 129 | 24 | 153 | 4,193 | |
| Migratory Bird Hunting Stamp Act..... | 29 | 127 | 14 | 142 | 3,705 | 45 |
| Lacey Act..... | | 16 | | 16 | 1,175 | |
| Black Bass Act..... | 2 | 2 | 2 | 2 | 450 | |
| Bald Eagle Act..... | 1 | 5 | 2 | 4 | 159 | |
| Halibut Act..... | | 2 | 2 | | | |
| Sockeye Salmon Act..... | 1 | 6 | 1 | 6 | 600 | |
| Assault Act..... | 2 | 5 | 2 | 5 | 1,700 | |
| Total..... | 615 | 1,035 | 464 | 1,186 | 160,434 | 21,615 |

¹ Includes \$2,575 suspended.

² Includes 845 days suspended.

MAINTAINING THE ISLAND FISHERIES

The Fish and Wildlife Service operated 92 hatcheries and propagated 24 species of fish for distribution to inland waters during the year.

Activities under the Columbia River fishery development program went forward at an increased pace. The end of the fiscal year found most construction funds committed for projects to get under way during the summer. This year, the Idaho Fish and Game Department entered the program, with investigations, installation of test screens, and development of plans for future construction.

Congress provided funds to initiate the construction of new hatcheries at Cedar Bluff (Kansas), Gavins Point (South Dakota), Pisgah National Forest (North Carolina), Paint Bank (Virginia), Bowden Springs (West Virginia), and Miles City (Montana); and to replace major facilities at Pittsford (Vermont). Congress provided funds also to continue the construction of new hatcheries at Millen (Georgia), North Attleboro (Massachusetts), and Pendills Creek (Michigan), and to improve and expand facilities at Hagerman (Idaho), Creston (Montana), Ennis (Montana), Williams Creek (Arizona), Inks Dam (Texas), Springville (Utah), Charlevoix (Michigan), Marion (Alabama), Welaka (Florida), and Chattahoochee Forest (Georgia). Construction of a new trout hatchery at Jackson (Wyoming) was

started by the Service with funds supplied by the Bureau of Reclamation.

Trout production at Federal hatcheries was increased approximately 10 percent by weight above any previous year. This increase was effected through the use of expanded and modernized facilities provided under the expansion program and through the application of improved techniques in fish culture. In addition to providing trout to stock waters on Federal lands, Federal hatcheries supplied the fish necessary to supplement State production programs. As an example of this assistance, the States of Pennsylvania and West Virginia received large numbers of legal-sized trout from Federal hatcheries to implement the State stocking programs when a significant portion of their own production had been lost through severe fish kills. In cooperation with New Mexico's Department of Game and Fish, the Service obtained a new strain of rainbow trout from Mexico. These fish were shared with the States of New Mexico and California, where progeny from this original stock are expected to survive and reproduce in waters now regarded as marginal. Studies on trout nutrition and the training program for trout-culturists were continued at the Cortland (New York) Fish-cultural Station in cooperation with the State of New York and Cornell University.

Drought conditions in major areas of the Nation were alleviated during the year. As heavy rains filled ponds and reservoirs, the demand for warm-water fish for restocking rose to an alltime high. Although the production of pondfish at Federal hatcheries was at approximately the same high level as in the previous year, this production was not sufficient to meet the increased demand. Channel-catfish production continued to gain in importance, especially in the southwestern and south-central States. More emphasis was placed on the production of walleyes and northern pike in the North Central region. The training of warm-water fish-culturists continued at the Marion (Alabama) station; use of improved techniques in the control of pondweeds, fertilization, and disease control formed part of the training program.

The use of air transportation for fish was increased; several large consignments were transported successfully to distant points. Parcel-post shipments of live fish in plastic bags were successful, but additional experiment will be necessary before this type of shipment can be considered practical.

The fishery-management services to Defense installations, Veterans Administration hospitals, Indian reservations, and wildlife refuges were particularly successful. Although services to hatcheries were limited by the small number of biologists available, these services contributed materially to the overall production of fish at Federal hatcheries.

TABLE 4.—*Fishes and fish eggs distributed—calendar year 1956*

| Species | Eggs | | Fry | | Fingerlings | | Fish 6 inches or larger | | Total | |
|----------------------|------------|-------------------------|------------|-------------------------|-------------|-------------------------|-------------------------|-------------------------|-------------|-------------------------|
| | Number | Weight <i>Pounds</i> | Number | Weight <i>Pounds</i> | Number | Weight <i>Pounds</i> | Number | Weight <i>Pounds</i> | Number | Weight <i>Pounds</i> |
| Largemouth bass..... | ----- | ----- | 436,850 | 78 | 14,430,426 | 27,745 | 3,712 | 962 | 14,860,988 | 28,785 |
| Smallmouth bass..... | ----- | ----- | 25,000 | 1 | 76,714 | 153 | ----- | ----- | 101,714 | 28,154 |
| Bluegill..... | ----- | ----- | ----- | ----- | 47,844,044 | 65,151 | 4,282 | 1,142 | 47,848,326 | 66,293 |
| Redear sunfish..... | ----- | ----- | 600 | 3 | 948,424 | 1,879 | 4,255 | 696 | 953,279 | 2,578 |
| Black crappie..... | ----- | ----- | ----- | ----- | 841,061 | 4 | ----- | ----- | 841,065 | 4 |
| Channel catfish..... | ----- | ----- | ----- | ----- | 19,310 | 8,903 | 64,615 | 4,497 | 905,676 | 12,500 |
| Bullhead..... | ----- | ----- | ----- | ----- | 50 | 478 | 100 | 125 | 19,410 | 603 |
| Buffalo fish..... | ----- | ----- | ----- | ----- | 608,755 | 2 | ----- | ----- | 50 | 2 |
| Walleye..... | ----- | ----- | 1,865,800 | 34 | 1,671,513 | 446 | ----- | ----- | 2,474,555 | 480 |
| Northern pike..... | ----- | ----- | 12,723,000 | 296 | 1,430,777 | 1,230 | ----- | ----- | 14,395,123 | 1,591 |
| Cutthroat trout..... | ----- | ----- | 253,010 | 57 | 11,405,118 | 1,790 | 35,029 | 7,386 | 718,816 | 9,233 |
| Rainbow trout..... | 2,835,431 | 519 | ----- | ----- | 74,282 | 170,284 | 2,938,925 | 699,176 | 17,179,474 | 869,959 |
| Steelhead trout..... | 47,627 | 13 | ----- | ----- | 74,282 | 4,385 | 289,636 | 27,824 | 32,222 | 32,222 |
| Lake trout..... | ----- | ----- | ----- | ----- | 695,469 | 8,111 | 248,118 | 17,200 | 943,587 | 25,311 |
| Brook trout..... | 3,679,086 | 524 | 300,000 | 50 | 916,171 | 16,883 | 728,440 | 170,807 | 5,623,697 | 188,264 |
| Brown trout..... | ----- | ----- | ----- | ----- | 517,205 | 6,611 | 383,856 | 100,576 | 901,041 | 107,187 |
| Grayling..... | ----- | ----- | 257,070 | 25 | ----- | ----- | ----- | ----- | 257,070 | 25 |
| Pink salmon..... | ----- | ----- | 493,000 | 325 | ----- | ----- | ----- | ----- | 493,000 | 325 |
| Chum salmon..... | 7,400 | 6 | 3,349,140 | 2,683 | ----- | ----- | ----- | ----- | 3,356,540 | 2,689 |
| Coho salmon..... | 60,144 | 48 | ----- | ----- | 883,766 | 18,873 | ----- | ----- | 953,910 | 18,921 |
| Sockeye salmon..... | 500,000 | 130 | ----- | ----- | 4,109,300 | 51,675 | ----- | ----- | 4,609,300 | 51,805 |
| Kokanee..... | ----- | ----- | 5,176,480 | 794 | ----- | ----- | ----- | ----- | 5,176,480 | 794 |
| Chinook salmon..... | 3,088,260 | 2,061 | 1,298,846 | 1,212 | 53,230,544 | 426,683 | ----- | ----- | 57,617,650 | 429,956 |
| Atlantic salmon..... | ----- | ----- | 96,738 | 60 | 284,412 | 2,033 | ----- | ----- | 381,150 | 2,093 |
| Total..... | 10,217,948 | 3,301 | 26,275,534 | 5,618 | 138,987,906 | 812,399 | 4,701,558 | 1,030,456 | 180,182,946 | 1,851,774 |

Although the production of trout increased and pondfish production was at a high level, the need for fish for stocking purposes exceeded the combined production of State and Federal hatcheries. Perhaps the greatest single factor contributing to the trout fishery of the future is the new trout areas that are being created below large dams on major river systems. As demands upon the sport fishery are expected to increase annually, the necessity for planning and for co-operation between agencies charged with the management of the resource has become more and more obvious.

The attached tabulation is a summary of data on the production and distribution of fish from Federal hatcheries in the calendar year 1956.

TABLE 5.—*Acreage acquired or in process of acquisition for fishery installations*

| State and station | Acquired in fiscal year 1957 | | | Pending title conveyance |
|---|------------------------------|-------------|-------|--------------------------|
| | By other than purchase | By purchase | Total | |
| Massachusetts: Woods Hole FBS..... | 1 | ----- | 1 | ----- |
| Mississippi: Pascagoula Fishery Lab. (CFS)..... | 2 | ----- | 2 | ----- |
| Montana: Miles City FCS..... | 168 | ----- | 168 | ----- |
| Vermont: Pittsford FCS..... | ----- | ----- | ----- | 2 |
| Washington: Little White Salmon FCS..... | 211 | ----- | 211 | ----- |
| Total..... | 382 | ----- | 382 | 2 |

Abbreviations:

CFS—Commercial fishery station.

FBS—Fishery biology station.

FCS—Fish-cultural station.

WILDLIFE RESEARCH

During the school year of 1955–56, 176 wildlife students were graduated from schools in the Cooperative Wildlife Research Unit program. This brings the total of such graduates to 2,549. For 21 years this program, carried on jointly by the United States Fish and Wildlife Service, the Wildlife Management Institute, and land-grant colleges and conservation departments of 16 States and the Territory of Alaska, has facilitated the training of wildlife personnel needed to implement wildlife-management programs. These units have conducted research on a wide variety of wildlife species and wildlife-habitat problems, promoted conservation education and extension, and provided technical assistance to conservation agencies.

Wildlife research this year has been channeled into two primary lines of investigation: (1) studies to maintain or increase populations of desirable wildlife species, and (2) studies to develop methods of controlling or reducing undesired species to levels consistent with man's economic interests.

The first of these lines of investigation involves inventorying the wildlife species and determining their status and distribution. As in any business, it is essential to know what we have to work with.

The second primary line of investigation was concerned with the development of animal-control methods. Studies were made of blackbird damage to corn, and a leaflet (WL-385) summarizing methods of control was issued for the benefit of corngrowers. Earlier work done by Service investigators on the blackbird-rice problem in Arkansas was published in Bulletin 584 of the Arkansas Agricultural Experiment Station. Preliminary investigations were made on the effects of nutria on marsh vegetation and the damage these animals do to levees and rice and sugarcane crops, in an effort to determine the economic status of this large rodent.

In the vast timber-growing regions of the United States, seedeating rodents and birds and browsing game animals seriously retard reforestation. The Service's two Wildlife Research Laboratories are screening hundreds of chemicals annually to find new tools to aid the forester, game manager, and landowner. They are striving to find better seed protectors than those already developed, and to extend that protection to the growing plant by using chemicals that are absorbed by the seed and retained temporarily in the plant after germination.

The use of tracking powders, whereby an animal ingests a lethal agent through grooming and cleaning its fur, offers a new approach for the removal of offending rodents. During the year three new rodenticides were registered and made available to the public. Food-habits studies of the pocket gopher pointed the way to better methods of controlling these locally destructive rodents. Progress was made in making the "coyote-getter" less hazardous to the public and more effective against coyotes and wolves.

Some 40,000 mourning doves were banded this year; this banding coupled with taxonomic studies, should provide a sounder basis for the annual dove-hunting regulations. Increased attention was given to the analysis of waterfowl-banding data, particularly those for the mallard, black duck, and canvasback, and plans were made for additional banding in critical areas. Followup studies were made on the white-winged dove in cooperation with State and private conservation agencies, and a long report on this species is being prepared.

Studies along the Atlantic coast indicated a practical way of correlating mosquito control with waterfowl-habitat improvement. Creation of marsh impoundments with stable water levels, useful to waterfowl and fish, resulted in production of fewer nuisance mosquitoes than in comparable unimpounded marshes. New herbicides for destroying cattails and phragmites were tested, and considerable

progress was made toward a practical chemical control for alligator-weed, one of the worst pest aquatics of the Southeast.

Research on farmland wildlife was carried out largely through the Patuxent Research Refuge and the Cooperative Wildlife Research Units. Patuxent studies have demonstrated that it is possible to produce good populations of farm game and at the same time produce excellent yields of corn, hay, and small grains, on land that had been abandoned as submarginal for agriculture. Some agricultural trends such as increased use of pesticides threaten to eliminate or reduce this important game resource unless safeguards are provided; pesticides are being studied in an effort to keep to a minimum their harmful effects on wildlife.

Timber-stand improvement, particularly in the South, has become a problem of major concern to those interested in forest wildlife. Tree mast, particularly acorns, is an important component in the diet of game birds and mammals. In many areas, elimination of acorn-bearing trees to make room for pine reproduction has drastically reduced the game-carrying capacity of the timberlands. Increased research is also needed on the use of herbicides to improve game range and to develop less harmful methods of application. It has been shown in the Lake States, for example, that mountain maples that have grown out of reach of deer can be top-killed with herbicides so that sprout growth is made available.

Diseases and parasites constitute an important natural means of limiting wildlife populations. During the past year studies were made of trichomoniasis, a throat disease that has caused high mortality among wild doves, and of aspergillosis in waterfowl. This fungus disease of the lungs and air sacs of ducks, geese, swans, and other birds has been associated with moldy grain; an attempt is being made to develop methods of diagnosis. In the West, scientists are tackling with increasing success the problems of avian botulism and fowl cholera, and are perfecting methods of diagnosis.

FEDERAL AID TO THE STATES

Wildlife Restoration

As in preceding years, the most important type of research carried out by the States under the Federal aid in wildlife restoration program was the collection of information about game-animal populations, reproduction success, and sportsmen's harvest. Inventory studies of this type were covered by 188 projects.

Increased cooperation among States has been highlighted as States realized the advantages of a coordinated approach toward common

problems. For example, all waterfowl studies are now coordinated through State-sponsored flyway councils, most of the States are co-operating with the Federal Government in banding mourning doves, and the Southern States have established a regionwide disease and nutrition study of deer, to be carried out by the University of Georgia.

The foreign game bird introduction program was continued with the delivery of 730 birds of three species from Spain and Pakistan.

During the fiscal year 285 publications—books, bulletins, and magazine articles—appeared in print, an important yardstick of program accomplishments.

Acquisition of land for wildlife management continued at an accelerated rate; 254,332 acres were leased or purchased with Pittman-Robertson funds during the year. In 11 projects, wildlife funds were combined with fish-restoration funds to acquire 11,873 acres and to lease 300 acres.

In operation were 329 wildlife-development projects aimed at producing benefits for all native wildlife species. Planting of trees, shrubs, aquatics, or herbaceous crops was carried out on a nationwide scale. Marsh impoundment for waterfowl and mammals continued to be an important activity, with 28 States using Pittman-Robertson funds to create new areas and improve existing areas. Over 5,000 acres of new marsh were created in 25 major construction jobs. Eleven lakes, exceeding 3,000 acres with benefits to both waterfowl and fish, were created in combination projects.

Additional facilities for hunter use of game ranges were established by 39 States and Hawaii; access roads and trails, parking areas, sanitary facilities, and directional and regulatory signs were installed. Twenty-eight States stocked new ranges or trapped animals for study purposes. Thirty-seven States reviewed the effectiveness of their wildlife-improvement activities through special evaluation projects.

Other activities included the erection of wood-duck and squirrel nesting boxes, weed, disease, and predator control, thinning forest lands, and salt distribution.

Fish Restoration

Fisheries investigations concerning a variety of important sport fish were carried out by the States in 139 projects. Greatest effort was devoted to warm-water fish, with trout and salmon following in that order. Marine studies were involved in 8 percent of the projects. The aquatic habitat—streams, ponds, natural lakes, impoundments, and marine waters—was investigated extensively.

While investigations involving a variety of habitats and species of fish cover a wide range of subjects, a trend toward certain types of activities was apparent in the past year. The principal emphasis

was on inventories to determine fish-population characteristics and angling success. Of the total investigational effort, 35 percent was devoted to these objectives; experimental management and evaluation studies accounted for 28 percent. The continued emphasis on these activities reflects the results of studies of preceding years and indicates the greater application of findings. During the year, 109 publications resulted from investigational projects.

Fish-restoration development projects were responsible for the construction of 37 lakes which will create almost 6,000 acres of public fishing water. Twenty-six States and Alaska improved fisherman-access facilities by providing roads, trails, parking areas, launching ramps, sanitary facilities, potable water, docks, and signs of various types.

Reclamation of waters, by removing undesirable fishes, was completed in 99 lakes having 10,417 surface acres. In addition, seven States conducted reclamation work on streams.

Related activities included construction of administrative buildings, roads, utility lines, fences, fish screens, firebreaks, watershed protection, and lake and stream improvement devices.

Acquisition of land for various fish-restoration needs continued with 16 States acquiring 2,979 acres and leasing 57,233 acres.

PREDATOR AND RODENT CONTROL ACTIVITIES

During the year the Fish and Wildlife Service continued its long-established cooperative program with agriculture and industry, for application of approved methods of reducing property losses caused by wildlife. Intensified effort was devoted to the field evaluation of new rodenticides, repellent chemicals, and scarce devices. The findings from these studies contributed to the development of a number of improved techniques for better management of certain wildlife populations.

Field personnel in Western States again concentrated on the protection of livestock, poultry, and game from depredations by predatory animals, such as coyotes and bobcats. Hazards associated with lethal devices for destroying such predators were further reduced in many areas by placing plastic warning signs adjacent to "coyote-getters," by using lighter propellant charges in coyote-getter shells, and by curtailing use of lethal devices in areas frequented by the public. The increase in human population in many parts of the West necessitated greater reliance on steel traps—a more costly and less efficient control method.

Predator populations increased in many localities. The ability of these animals to live in close proximity to human habitation was particularly apparent in Los Angeles County, Calif. During De-

cember 1956 a Service hunter stationed in the area removed 21 coyotes from suburban communities. Many of the animals were living in areas adjacent to heavily traveled parkways, and several were trapped on the property of a large motion-picture studio. Comparable conditions prevailed throughout sections of the Midwest where human activity in rural areas precluded the use of lethal materials for the protection of small bands of sheep in farm pastures. The situation has become acute in portions of Oklahoma, and officials at the A. and M. College now consider predation by coyotes the major deterrent to successful sheep production in that State.

Considerable effort was devoted to the control of domestic rats and mice, field rodents, rabbits, and other small mammals that had become destructive. The work included large-scale field testing of two new anticoagulant rodenticides, PMP and diphacinone. In addition, there was extensive operational use of warfarin, pival, and fumarin in the clean grain program, especially throughout the Dakotas. The effectiveness of these chemicals has made possible a marked reduction in rat losses; however, contamination of products by mice is a matter of growing concern to the grain-handling industry.

Reports from the Pacific Northwest and Gulf Coast States indicated an upswing in damage by rabbits. Upwards of 195,000 pine seedlings in a Mississippi forest nursery were destroyed by these animals during the past winter. In another instance, only 6 seedlings survived rabbit damage on one 20-acre field where a total of 100,000 trees had been planted the previous year. Rabbits have been similarly destructive on tree farms in western Washington. In addition to damage by various native animals, the South also reported losses of rice, sugarcane, and aquatic duck food due to nutria. These South American rodents are valuable as furbearers, but their introduction into agricultural areas has resulted in instances of severe damage to crops and water-control structures.

Field personnel participated in testing an endrin-arasan repellent on tree and watermelon seeds. The chemical formulation proved useful in preventing damage by several species of seed-eating mice. Sublethal amounts of endrin-coated seeds tend to make the animals ill but do not kill them. The rodents are thus "educated" that such seeds are not desirable as food material.

The high postwar incidence of rabies in wildlife continued, and Service personnel in many sections of the country assisted county officials in carrying out control measures. Outbreaks of rabies in foxes were particularly severe in Virginia, Louisiana, Alabama, Georgia, and Texas. In these areas, trapping projects were undertaken to reduce local fox populations and curtail spread of the disease.

Field operations in Alaska were concentrated on a study to obtain more information on wolf-caribou relations. Many instances of predation of big-game animals were noted during the year. In southeast Alaska, Service personnel sighted a pack of five wolves which were taken after they had killed no less than nine deer during a 2-day period. In the Tanana River area, upwards of 170 moose kills due to predation by wolves were noted. Service hunters destroyed 18 of the wolves in 1 day through the use of aircraft.

Cooperative predator and rodent control operations during the fiscal year 1957 entailed expenditures of \$1,757,796 from regular departmental appropriations, supplemented by \$1,462,435 from cooperating States and \$1,366,481 from cooperating counties, livestock associations, and others. The recorded catch of predatory animals by Bureau and cooperative personnel was 62,585 coyotes, 2,790 wolves, 22,198 bobcats and lynx, 1,039 stock-killing bears, and 267 mountain lions. In rodent-control operations, 9,800,212 acres of land were treated for elimination of prairie dogs, ground squirrels, pocket gophers, jackrabbits, field mice, cotton rats, kangaroo rats, porcupines, woodchucks, and moles. In addition, 548,038 premises were treated in cooperative campaigns for the control of rats. Special equipment and supplies used in both predator and rodent control, and 336,470 pounds of rodent-bait materials, were distributed by the Service's supply depot at Pocatello, Idaho.

RIVER BASIN STUDIES

The Fish and Wildlife Service issued 340 reports this year on the fish and wildlife aspects of water-development projects planned, cost-shared, or licensed by the Federal Government. Of these, 135 were projects of the Corps of Engineers and 30 were projects of the Bureau of Reclamation. Reports on locally sponsored projects which are only cost-shared by the Federal Government included 102 on small watershed projects assisted by the Soil Conservation Service and 8 on the small reclamation projects which receive assistance through the Department of the Interior. There were 65 reports on power projects requiring license from the Federal Power Commission, and 24 reports on special and miscellaneous subjects.

In line with the Coordination Act of 1946, plans were completed between construction and State conservation agencies for use of 11 water-use projects by the State agencies for wildlife management. These include the Bonnet Carre Spillway area in Louisiana and lands at the following reservoirs: Bayou Bodcau in Louisiana, Boysen and Keyhole in Wyoming, Denison in Oklahoma, Indian Rock in Pennsylvania, Lucky Peak in Idaho, San Angelo and Texarkana in Texas, Tiber in Montana, and Webster in Kansas.

An interim report was prepared on the proposed Bruces Eddy project in Idaho. Studies thus far indicate that the project would result in the loss of about 40 percent of the elk and 60 percent of the deer using the range to be affected. Before an estimate of the effect of the high dam on fishery resources can be evaluated, more data are needed on present fish populations, harvest, distribution of spawning gravels for anadromous fish, and other characteristics of the fishery and its habitat requirements.

A proposed partnership project of the Nebraska Mid-State Reclamation District provides for integration of fish and wildlife conservation in its plan for development of irrigation, power, and municipal water storage along the Platte River. The report on this project points out modifications in the original plan which would result in additional fish and wildlife and recreational benefits.

A report on fish and wildlife of the proposed Garrison diversion project in North and South Dakota was completed and coordinated with the Bureau of Reclamation's engineering plans. The fish and wildlife report assesses the effects of the project on these resources and certain Federal waterfowl refuges. The development of 62 fish and wildlife areas is expected to compensate largely for waterfowl habitat which would be lost and also provide benefits to fish and other wildlife. These plans are incorporated in the project plan approved by the Secretary of the Interior.

The solution to critical problems associated with water-use developments involving anadromous fishes (salmon, steelhead trout, striped bass, and shad) have required the combined efforts of several Service branches.

The Snake River, one of the largest salmon-producing tributaries of the Columbia River, was the scene of much activity. During the past year, the Department recommended that fish-passage facilities be installed at the Idaho Power Co. dams—the Brownlee, Oxbow, and Hells Canyon dams in Idaho and Oregon. General plans for a downstream fish-collection system were recommended to the Federal Power Commission in order to meet construction schedules at Brownlee Dam. Fish-passage devices will be required also at Ice Harbor Dam, now under construction near the mouth of the Snake River.

Priest Rapids and Rocky Reach Dams on the main stem of the Columbia River in Washington and Pelton Dam on the Deschutes River in Oregon are under construction. Other dams scheduled for early construction on tributary streams are the Swift project on the Lewis River in Washington and the North Fork Dam on the Clackamas River in Oregon. Fish and Wildlife Service technicians are working out ways to preserve runs of salmon and steelhead at these projects. At Savage Rapids Dam on the Rogue River in Oregon, detailed plans were developed for installing screens to prevent the loss

of young seaward migrants. To prevent losses of anadromous fish in connection with construction of dams on the Trinity River in California, a fish hatchery will be built by the Bureau of Reclamation.

The Department, on the basis of findings of the Fish and Wildlife Service, advised the Federal Power Commission that it does not recommend the issuance of a permit for the proposed Wood Canyon Dam on the Copper River in Alaska in view of the difficult problems of salmon passage involved. To increase the dissolved-oxygen content of the water in the Roanoke River below Roanoke Rapids Dam in North Carolina, construction of a submerged weir surrounding the intakes of the turbines has been initiated by the licensee. Federal and State conservation agencies plan to study the effectiveness of this weir in improving the stream for striped bass.

Studies are being continued at Narragansett Bay in Rhode Island to determine the effect on shellfish and finfish of hurricane-control barriers proposed by the Corps of Engineers.

The Service submitted its first two detailed reports to the Soil Conservation Service concerning small watershed projects. They are Ten Mile Creek in Minnesota and Toogoodoo Creek in South Carolina. Both reports recommended measures to mitigate fish and wildlife losses, and these recommendations are being considered by the Soil Conservation Service in the revision of original plans. Of 172 reconnaissance reports submitted by the Fish and Wildlife Service to date on these locally sponsored projects, 7 indicated that fish and wildlife losses would be great enough to warrant detailed studies by the Service.

Prospects for preservation of privately owned marshes, potholes, and other wet areas look less gloomy today than during the past several years. Restrictions imposed by the Department of Agriculture on drainage assistance rendered to farmers have helped reduce some losses of aquatic habitat. There also appears to be a greater public awareness, particularly on the part of private conservation organizations, that wetland drainage should be curtailed during these times of agricultural crop surpluses. Congress also has shown interest in investigating the need for federally assisted drainage at this time.

BUREAU OF COMMERCIAL FISHERIES

Donald L. McKernan, *Director*



COMMERCIAL FISHERIES

THE Fish and Wildlife Service's responsibility to the welfare of the fishing industry is being met by exploratory, technological, market-development, economics, statistics, and market-news programs to aid in the preservation and proper utilization of fishery resources.

With the passage of the Fish and Wildlife Act of 1956, the Saltonstall-Kennedy Act was made permanent. Each fiscal year an amount equal to 30 percent of customs duties collected on imported fishery products is made available for various types of fishery research and services to develop and increase markets for domestic fishery products.

The 10-million-dollar fisheries-loan program, authorized by the Fish and Wildlife Act of 1956, is in operation. Loans are for financing and refinancing of operations, maintenance, replacement, repair, and equipment of fishing gear and vessels, and for research into the basic problems of fisheries.

The technological fishery research program, oriented to the solution of industry problems, has been extended by contract research at 32 of the Nation's leading research centers. Fundamental research is conducted in the broad fields of improved utilization, quality and processing studies, standardization, and nutrition and radiation preservation of fishery products. Results are made available to the industry through consulting services, publications, and plant visits and demonstrations. Some outstanding results of the coordinated basic research include development of a technique for retaining desirable pink coloration of canned tuna and the use of menhaden oil in leather processing. Applied research is exemplified by progress in the development of voluntary United States standards for fishery products. Standards for frozen fried fish sticks became effective last year, and

several other standards are in the process of development or promulgation. Seven fish-processing plants now have continuous inspection service.

Commercial utilization on a small scale of deep-water royal-red shrimp off the southeastern States and tuna from the Gulf of Mexico is reported. These resources were discovered in earlier explorations by the exploratory vessel *Oregon*. As a result of exploratory fishing and gear studies by the *John N. Cobb*, a new shrimp fishery is being exploited off the Washington coast. Exploratory long-line fishing by the *Delaware* in North Atlantic offshore waters indicates the availability of tuna of several species north of their known winter ranges and points out a new pelagic resource of potential value. An inexpensive and simple electrical telemeter has been designed and constructed to measure the exact fishing depth of nets—an important step in the development of practical midwater trawls.

Regulatory activities and reports on fishery cooperative marketing associations are continued in accordance with the authority of the Fishery Cooperative Marketing Act of 1934. On June 30, 1957, there were 81 active fishery cooperative marketing associations in the United States and Alaska.

Transportation rate increases and problems and their effect on the fishing industry are studied. The problem of imports of ground-fish fillets and tuna is under constant study. Final reports are in preparation on fish marketing and consumption in the Pacific Coast States, on an economic survey of the domestic shrimp industry, and on a survey of fishing vessel hull and personal and indemnity insurance. A report on household consumer preferences for canned fishery products reveals information on markets. Three new studies are in progress: (1) a study of the interaction of biological and economic forces in the fisheries; (2) a study of the effects of controlled production and marketing conditions on the halibut fishery; and (3) a study of the factors which affect prices for key fishery products such as canned salmon and fresh oysters.

Service home economists gave 244 fish-cookery demonstrations for school lunchroom personnel, extension agents, home-economics classes, and institutional groups. Special market-promotion campaigns on fresh fish were conducted in three cities as well as a national industry-Government cooperative campaign for canned tuna and for "National Fish Parade."

Two market-development motion pictures were finished and placed in distribution. An award was given the Department by the British Government in recognition of the Service-produced industry-financed film "Outboard Fisherman USA." Sales of over 60,000 copies in less

than 5 months were reported for the full-color recipe booklet "Shrimp Tips from New Orleans."

A program to find markets for certain underutilized fish in Lake Erie is showing results with the marketing of a large harvest of sheepshead to fur-animal farms and pet-food manufacturers. A market has been opened in the Midwest for the cocktail shrimp of Alaska. New markets for Pacific Coast Dungeness crabs have been developed in Florida.

To aid in the orderly marketing of fishery products and byproducts, marketing specialists in fishing and distribution centers collect daily marketing information. Timely information is disseminated through daily reports by the seven Fishery Market News Service field offices, in Boston, New York City, Hampton, New Orleans, San Pedro, Seattle, and Chicago. These reports are used extensively in the fishery industries, conservation work, granting loans, supplying background data for governmental actions, research, and determining the economic importance of the fisheries. Expansion of market news coverage for frozen and canned fishery products has been initiated. The first of a series of reports on the status of segments of the fisheries was issued.

The monthly periodical, *Commercial Fisheries Review*, continued to feature articles and news of trends and developments in the fishery industries of the United States and foreign countries.

General statistical surveys of the fisheries for 1955 were completed for all sections of the United States. Similar surveys for 1956 were undertaken. Monthly bulletins on landings of fish and shellfish in 12 coastal States and Ohio are published. Detailed data are collected on Maine and Massachusetts landings by individual vessels, area of capture, etc., and on the shrimp fishery of the Gulf of Mexico and the South Atlantic States. Detailed economic and biological statistical tabulations are released periodically.

Monthly bulletins are released on domestic freezings and holdings of fishery products, the production of fish meal and oil, and United States foreign trade in fishery products. Quarterly reports on the yield of fish sticks and annual bulletins on the production of canned fishery products, byproducts, and packaged fish also are released.

RESEARCH IN FISHERY BIOLOGY

Coastal Fisheries

The Service, as research agency of the Atlantic States Marine Fisheries Commission, continued its investigations of Atlantic-coast shad

fisheries to determine causes of declines and conditions favoring recovery.

In the Connecticut River, research has shown that shad production depends on permitting a sufficient number of fish to spawn. From previous work on the river, Service biologists can predict the size of the shad run a year in advance so fishing regulations can be set to provide for a proper escapement of spawners.

In the Hudson River, as a result of a decrease in shad fishing since 1950 with consequent increase in escapement of spawners, the shad run is nearing its former high level. A run of almost 6 million pounds was predicted for 1957. In 1956 the run was about 4.1 million pounds and the commercial catch was about 1.8 million pounds; in 1950 the run was about 1.4 million pounds and the commercial catch was just short of a million pounds.

On the Delaware River, the depletion of shad was caused primarily by pollution in the Philadelphia-Camden area. Although some anti-pollution action has been taken, the river is still too polluted for restoration of the fisheries.

Research continued on the striped bass of Albemarle Sound and the Roanoke River, with a large-scale tagging program to determine annual populations in relation to spawning conditions.

In February 1957 the Service and the States of Virginia and Maryland began an investigation to determine what percentage of striped bass spawned and reared in Chesapeake Bay take part in the northern coastal migration, and to measure the exploitation of Chesapeake Bay stocks by sport and commercial fisheries inside and outside the bay.

In cooperation with the State of Maine, research continued on the Atlantic Salmon in Sheepscot River.

Electrical methods of counting fish were also advanced through improvements in instruments and through field experience. Progress was made also in engineering research on electrical guiding of fish, on the nature of the electrical fields, and on prediction of power demand of different electrode arrangements. Projects have been started to use electric fish counters for large numbers of fish. Continued studies of sonic tags for fish showed that adult salmon carrying the sonic tags can be tracked for periods up to 8 hours.

Reactions of over 10,000 adult salmon and steelheads were measured at the Fisheries-Engineering Research Facility at Bonneville Dam during 1956 to find more economical methods of providing safe passage for the fish.

Above Rock Island Dam on the Wenatchee River system, progress was made on studies by the proposed Chelan County Public Utility District hydroelectric power project. Fishery research was directed

toward ascertaining the magnitude, the timing and spawning areas of anadromous fish runs into the system, and the timing of the downstream migration of the young fish. Surveys in the summer of 1956 on all the tributaries and the main stem of this system showed the spawning areas utilized by salmon in relation to the areas to be inundated by the impounded waters. Water-quality data were collected from five stations on the Columbia River and six stations on the Wenatchee River system.

To determine production of young salmon from a specific year's spawning run, a trapping station was established at the Prosser canal bypass at Prosser, Wash., and a daily and seasonal trend of migrating fingerlings was established by operating the trap 24 hours daily. The Columbia River blueback-survival studies showed that most of the bluebacks spawn on the Okanogan and Wenatchee River systems in Washington and at Redfish Lake in Idaho. A 10-year fingerling migration study at Bonneville Dam ended during the year. At bypass traps, information was collected on species, age and size, and migration, time of migration, numbers of marked fish, and identity of marks.

The Milford Laboratory and the State of Connecticut Department of Shellfisheries established oyster-spawning beds at the mouths of several rivers and will keep them under observation. The laboratory also worked with the Oyster Institute of North America to develop methods for using salt-water ponds for shellfish culture. The hardiness of the strain of the European oyster, *Ostrea edulis*, bred at Milford was demonstrated.

Experiments in Chesapeake Bay to control oyster drills were effective enough to assure production of seed oysters. In Chincoteague Bay, trapping the drills was effective. Field trials confirmed laboratory findings that copper fencing will repel drills.

In New England, all phases of the life of green crabs have been under study to determine the cause of their increase and to find methods of control. Increase in predation by green crabs was largely responsible for the decrease in the abundance of soft clams north of Cape Cod in recent years.

Experiments with oyster-raft culture were carried out at Oyster River in Massachusetts. Studies consisted in recording the rate of growth and mortality of oysters kept above the sea bottom away from predators and determining the principal ecological factors affecting them.

Studies continued on measurements of accumulated radioactivity from uptake of fission products by fission organisms, the nature of the radio activity accumulated in various parts of the body, and levels



FIGURE 36.—A fish's reaction to fishing gear can be seen through miracle of underwater television. These studies have led to prescribed mesh size of net to conserve small fish by permitting their escape during normal fishing operations.

that could be passed to man through use of seafoods or other marine products. Studies of the biology of plankton and shellfish by means of radioisotopes as tracers have been undertaken. Research along this line centered on planktonic food organisms and feeding mechanisms of shellfish.

Inland Fisheries

The Microbiological Laboratory, Leetown, W. Va., serves the eastern United States as a center of research on the nature, treatment, and prevention of infectious diseases of fish, and as an advisory center for Federal, State, and private hatcheries. From the economic standpoint its most important project is research on kidney disease which is scattered in trout and salmon hatcheries all over the United States and is still spreading. Tests on experimental fish and losses occurring in hatcheries show the high mortality of fish infected with this slow-spreading disease. The Western Fish Disease Laboratory at Seattle, Wash., is expanding its study by cooperating with Oregon, Idaho, and Washington fishery groups and the International North Pacific Fisheries Commission to determine sources of infections in fish.

Experiments were completed at the Willard Laboratory, Cook, Wash., on the quantitative vitamin requirements of chinook salmon, and a cooperative research program was started with the State of Washington Department of Fisheries to test the qualitative vitamin requirements of sockeye salmon. Feeding trials at the Entiat, Wash., laboratory demonstrated that an effectively bound diet increases utilization by 100 percent. Tests showed that a reduction in normal light exposure can accelerate maturation of sockeye salmon.

Sea-lamprey control was confined to Lakes Superior and Michigan with the exception of an experimental barrier on Lake Huron. Research was directed at testing specific larvicides and operating direct-current electrical diversion devices. After many experiments with thousands of compounds over the past several years, two chemicals were selected as most effective. Installation and operation of seven experimental direct-current devices in combination with alternating-current control barriers in Lake Superior problem streams reduced fish mortality from 85 percent to 8.5 percent.

The research vessel *Cisco* made a hydrographic and fishery survey of Saginaw Bay and southern Lake Huron during the summer. The *Cisco* also surveyed Lake Erie to learn the distribution and relative abundance of various species of noncommercial and commercial fish in different areas and at different times of the year. Commercial landings at various ports on Lake Erie were sampled and an inquiry into the age, size, and year-class composition of the walleye and blue pike continued.

Marine Fisheries

Much of the research program in the North Atlantic was developed in collaboration with the International Commission for the Northwest Atlantic Fisheries through its Committee on Research and Statistics. Studies of cod, haddock, ocean perch, and halibut were continued on several of the fishing banks. Underwater television was demonstrated to be a practical research tool, in studying the capture, behavior, and escapement of fish through trawl meshes.

Ocean perch were successfully tagged for the first time in history at Eastport, Maine; 3,385 were tagged from the end of July to mid-November 1956. Recaptures are beginning to yield data on age, growth, migration, and mortality.

Investigations into the life history and biology of the Atlantic menhaden continued, to determine changes within populations and their effect on the fishery.

Methods have been devised for tracing movements of young shrimp. One is feeding the shrimp chopped fish stained with dyes; another is immersing the shrimp in a dilute solution of riboflavin or feeding shrimp with mullet soaked in riboflavin, thus producing luminescence. The staining method is being tested in field holding tanks before commencing trial releases.

From the association of "red tide" with climatic and hydrographical conditions it appears that accurate red-tide forecasting may depend on accurate long-range weather predictions. Work with chemically defined media to establish the nutritional requirements of the red-tide organism was continued.

As an aid to understanding the distribution abundance of Pacific sardine populations, several ecologically associated species are being investigated. Studies at Stanford, Calif., continued on relations between climatic and ocean conditions and sudden fluctuations in major commercial fish stocks on the customary fishing grounds.

The count of gray whales at Point Loma, Calif., during their annual southward migration was the highest since the census was instituted; 1,782 whales were counted.

Biological and exploratory research on Pacific tuna resources continued, with investigations of skipjack in the Marquesas area and in Hawaiian waters, and of albacore in the eastern North Pacific.

In August and September 1956 the Service participated in Operation EQUAPAC, an oceanographic survey of the central and western equatorial Pacific by Japan, the United States, and France.

Participation in the International Geophysical Year began in June 1957, with occupation of an oceanographic station off the Hawaiian Islands.

CONSERVATION OF ALASKA COMMERCIAL FISHERIES

Statistics of the Fishery

In 1956, products of the Alaska fishing industry, including fur-seal byproducts, totaled 226,357,141 pounds with a wholesale value of \$92,960,379, as compared with a total of 186,159,932 pounds valued at \$69,722,887 in 1955. Salmon increased from 131,280,885 pounds valued at \$60,617,136 in 1955 to 160,569,980 pounds valued at \$81,955,083 in 1956; herring increased from 23,025,111 pounds valued at \$1,531,354 in 1955 to 32,721,689 pounds valued at \$2,262,660 in 1956.

Considered by regions, the principal increases were in herring production in Southeastern Alaska and salmon production in Western Alaska, where an excellent run of red salmon developed in the Naknek-Kvichak district of Bristol Bay. This run was of such magnitude that for the first time since the 1930's the canneries had to put the fishermen on limits.

FIGURE 37.—With private, State and other Federal agencies cooperating, 1,850,000 pounds of game fish were planted from fish cultural stations of the United States Fish and Wildlife Service during 1956. Wilderness area waters in Alaska are regularly planted with airlift fish.





FIGURE 38.—Treaties between Canada, Japan, Russia, and the United States for the protection of fur seals and management providing for a systematic harvest that has insured a sustained yield have contributed an outstanding chapter to American conservation. The average annual harvest of 65,000 seals has been valued at approximately \$6 million.

There were 23,598 persons engaged in the fisheries of Alaska in 1956, of which 12,507 were fishermen, 1,510 were transporters, and 9,581 were shoresmen, operating out of 168 wholesaling and manufacturing establishments. Gear used in taking salmon included 1,136 purse seines, 256 beach seines, 8,072 gill nets, 238 traps, 22,369 troll hooks, and 8 fish wheels.

In administering the commercial-fishing laws and regulations in Alaska in 1956, the Fish and Wildlife Service employed a total of 295 temporary streamguards in addition to permanent personnel.

Research

Research was moved from the Seattle Laboratory to Juneau during 1956, and the staff was considerably augmented. New research projects initiated during 1956 included study on the development of a method of recording escapement of salmon in small streams, research on the effects of logging on the productivity of pink-salmon streams, a study of sea lions and hair seals

in Central and Western Alaska, and enumeration of migrant fingerling red salmon in the Egegik and Naknek Rivers in Bristol Bay, in addition to regular research work.

PRIBILOF ISLANDS FUR-SEAL INDUSTRY

Sealing operations on the Pribilof Islands, Alaska, during 1956 produced 122,826 sealskins compared with 65,638 taken in 1955. The increased kill was made to begin the elimination of excess animals from the herd. As in other recent years, the take was divided in accordance with the Provisional Fur-Seal Agreement of 1942 between the United States and Canada whereby 20 percent of the skins are delivered to the Government of Canada. Production on the islands also included 626.1 tons of fur-seal meal and 88,277 gallons of oil. The meal and oil were sold later by competitive bidding for a gross total of \$105,229.

During fiscal year 1957, the following quantities of United States Government-owned fur-seal skins were sold at public auction in St. Louis, Mo.: On October 5, 1956, 26,890 skins were sold for \$2,687,703, and on April 12, 1957, bidders paid \$2,521,710 for 27,819 skins.

FOREIGN ACTIVITIES

During the past year the international fishery commissions of which the United States is a member and in whose work the Fish and Wildlife Service has a direct interest continued to make progress.

Under a modified regulatory system and an expanded investigatory program, the Halibut Commission has been able to maintain the catch at high levels. The catch during the 1956 season was 67 million pounds, which is well above the average for the past 5 years.

In September 1956 the Governments of Canada and the United States signed a Protocol to the Convention on Sockeye Salmon of the Fraser River System, bringing the pink salmon of that river under the jurisdiction of the Sockeye Salmon Commission. Improved management of the pink-salmon resource is expected from this action.

The joint Japanese-Canadian-United States research program being carried out under the auspices of the International North Pacific Fisheries Commission has made gratifying advances, with major discoveries regarding the distribution and migration of North Pacific salmon.

Mesh regulations for the haddock fishery adopted by the International Commission for the Northwest Atlantic Fisheries in 1953 have demonstrated their effectiveness by producing an increase of at least 30 percent in the yield of the 1952 year class in its first 3 years in the fishery.

In its first year, the Great Lakes Fishery Commission has continued and improved upon the lamprey-control programs previously conducted by the Governments of Canada and the United States and has begun the formulation of a comprehensive program of research on fishery problems in the Great Lakes.

The investigations of the Inter-American Tropical Tuna Commission have made possible an understanding of the fundamental dynamics of the populations which support the United States tuna industry, and have provided a basis for an estimate of the potential maximum sustainable yield of the resource.

In February 1957 the Governments of Canada, Japan, the U. S. S. R., and the United States signed an Interim Convention on the Conservation of the North Pacific Fur Seals. The convention, which awaited ratification at the end of the fiscal year, would make possible cooperation between the four nations bordering on the North Pacific Ocean in the conservation of this valuable resource.

The Service continued to assist the International Cooperation Administration in carrying out the foreign-aid program. During the past year, fishery development programs were carried on in Peru, Liberia, Pakistan, India, Indonesia, Thailand, Vietnam, Taiwan, and Korea. A number of foreign students and administrators received instructions in the United States in various phases of biological science and management of fishery resources.

Office of the Administrative Assistant Secretary

D. Otis Beasley, *Administrative Assistant Secretary*



DEPARTMENTWIDE administrative management responsibilities of the Secretary are executed by the Administrative Assistant Secretary. In performing this function the Administrative Assistant Secretary directs and supervises seven secretarial divisions. These are administrative services; budget and finance; inspection; management research; personnel management; property management; and security.

Following is a record of each division's activities during the past year:

Division of Administrative Services

Floyd E. Dotson, *Director*

Activities of the Division during fiscal year 1957 were concentrated in the performance of housekeeping and basic operating functions for the Office of the Secretary, other Departmental units, and the Commission of Fine Arts. The Division also provided a wide variety of centralized services to other Interior bureaus and offices in Washington and the field. Performance figures for each major function of the Division are given below.

Library Services.—Use of library facilities continued upward. Some 37,476 reading room patrons, 22,101 telephone calls, 101,917 items circulated, 9,932 interlibrary loans, and 18,202 reference inquiries represent an average increase of 20 percent over 1956.

Fiscal Services.—The Office of the Secretary, other Departmental units, the Commission of Fine Arts, and the President's Council on Youth Fitness were provided with normal accounting services during the year. Expenditures for these offices totaled about \$7 million. Operations financed under the reimbursable working capital fund amounted to more than \$1,400,000. Approximately 1,000 employees were supplied with payrolling services. Accounting control, including budgeting and reporting, was maintained over the approximately \$3,500,000 of new funds transferred from other agencies for use by various bureaus of the Department.

Records Management.—Records holdings within the Office of the Secretary were reviewed, and approximately 450 cubic feet of obsolete material was destroyed. Seventy file cases were cleared out for reuse. The official personnel records on all employees and officials under Secretarial appointive authority were transferred from the Central Files Section to the Branch of Personnel Operations.

Personnel Operations.—During the year particular emphasis was placed on recruitment and placement problems, and previous procedures were simplified so that individual offices are now kept better informed on current developments. Normal personnel services were maintained for the Office of the Secretary and other Departmental units.

Museum.—More than 46,000 people, from all States and from 52 foreign countries visited the Department Museum. Educational and historical motion pictures were especially popular, with more than 20,000 viewers, a 100 percent increase over 1956. Normal exhibit preparation and maintenance continued throughout the year.

Central Services.—Statistics for 1957 show 20,000 duplicating requisitions, 15,000 photographic jobs, 7,500 requisitions for stock supplies, 5,300 dispensary treatments, 3,200 telephone changes, and 3,200 printing and binding requisitions, and 2,800 procurement actions.

Division of Budget and Finance

Sidney D. Larson, *Director*

The Division of Budget and Finance is responsible for staff supervision of the budget and financial activities of the Department and represents the Department in these fields in liaison with the Bureau of the Budget, other Federal agencies, and appropriation committees of Congress.

Appropriations made to the Department for the fiscal year ending June 30, 1957, totaled approximately \$537 million, of which \$223 million was appropriated to the Bureau of Reclamation and the power marketing agencies and \$314 million to the other bureaus of the Department.

The Division continued its review of the Department's budget structure in the interest of synchronizing organization structures, budgets and accounting systems. It continued work on improving the budget justifications submitted to the Bureau of the Budget and the Congress to make them concise, easily understood and, at the same time, fully reflect the need for the funds requested. In addition, the staff engaged in a continuous review of the programs of the bureaus aimed at reducing obligations and expenditures.

The Division participated in the joint program of the Bureau of the Budget, Treasury Department, and General Accounting Office for improving accounting and fiscal reporting. A program scheduling future improvement of financial management within the Department was transmitted to the Bureau of the Budget. Assistance was given to the National Park Service in the installation of a modern accounting system in the various fiscal offices of the Service. Review was made of the accounting systems of the Government of the Virgin Islands and the Trust Territory of the Pacific Islands. Continued assistance was provided other bureaus of the Department in accounting systems improvement and other fiscal matters.

The Division continued to cooperate with the General Accounting Office and with the bureaus of the Department in the comprehensive audit program and provided the leadership for correcting deficiencies in fiscal and other matters set forth in the audit reports.

Division of Inspection

W. Darlington Denit, *Director*

The Division of Inspection is responsible for the inspection and investigative activities of the Department. Major responsibility for actual inspection performance is placed in the bureaus of the Department. During the past fiscal year there has been measurable progress in the development of inspection programs in the bureaus. The most notable areas of progress in the inspection activity have been the development of field inspection at area and regional office levels and the

diversity of the various functions covered by inspection. Through the media of the inspection program many disclosures of weaknesses in administrative procedures have been made and corrective actions instigated.

The major underlying purpose of the Department's inspection program is to preserve and foster high standards of moral and ethical conduct in the management of the Department's affairs. The increasing momentum of the inspection effort is also providing information which enables the anticipation of regulatory needs and the application of corrective measures.

The investigative phase of the activities of this Division has been sponsored by the Department for many years. This activity extends, in the main, to special investigations of alleged administrative irregularities in the discharge of official duties. Special investigations of other matters within the responsibility of the Department are conducted as authorized by the Administrative Assistant Secretary. Only limited investigative authority has been delegated to the bureaus. The workload in the Branch of Investigations has been especially heavy during this past fiscal year but cases are being handled on a current basis in all respects.

The Government employment policy of nondiscrimination, as provided in Executive Order 10590 and related Department regulations, is being applied on a departmentwide basis. Specific complaints of discrimination have been at a minimum and periodic checks have revealed effective policy compliance in all bureaus.

Division of Management Research

Arthur B. Jebens, *Director*

A prime objective of the Department is to increase the effectiveness of its programs with a minimum of increases in appropriations and employees. The Division of Management Research is responsible for initiating, defining, and coordinating work throughout the Department to accomplish this objective.

The Division cooperated with the Fish and Wildlife Service and the Bureau of the Budget in preparing organization plans for, and negotiating with other agencies for the transfer of functions to, the new Fish and Wildlife Service created by the Fish and Wildlife Act of 1956.

The policy recommendations of the Commission on Intergovernmental Relations were reviewed, and surveys were begun of the Department's grant-in-aid programs; the survey of the Bureau of Mines' anthracite mines drainage program was completed during the fiscal year.

The General Services Administration cooperated with the Division in a departmentwide survey of paperwork management activities to evaluate the present effectiveness of these activities and propose recommendations for their improvement. The Division also developed plans to improve and speed the processing of secretarial mail.

The rapid progress of electronic computation and data processing is making available increasingly versatile equipment; three bureaus of the Department (Mines, Geological Survey, and Bonneville Power Administration) already have computers. The Division of Management Research is responsible for developing and coordinating systematic means for increasing knowledge and exchanging experience about computers. A Manual Release defining computer policies was prepared and a Departmental Automatic Data Processing Committee established.

The following list is a cross section of other Division projects:

1. Revised the Department's Emergency Operations Handbook after a reappraisal of essential wartime functions and attack assumptions.
2. Analyzed the operation of the World War I Federal Explosives Act, resulting in a recommendation for its repeal.
3. Prepared a report on the administration of laws on the withdrawal of public lands for Government use.
4. Assisted the affected bureaus in applying the recommendations of the land appraisal report and in developing training programs for appraisers.
5. Prepared a Manual Release defining the jurisdiction of Interior bureaus on public lands under their control as discriminated from the jurisdiction of State and local governments.
6. Prepared a regulation governing the making of motion pictures and TV productions on Interior lands.
7. Lead a survey team that examined the Bureau of Land Management's timber management in the western Oregon lands.
8. Prepared a report outlining organization and management possibilities for carrying out forestry and associated functions of the Interior and Agriculture Departments.

9. Continued the bimonthly publication of Management Highlights, containing articles on administration and management improvements.

The Division's Branch of Directives Management assisted Bureaus and Offices in developing material for the Departmental Manual, and

in administering their internal manual systems; and served as a central clearing point for Federal Register documents.

The Division's Branch of Incentive Awards reported a 56 percent increase in suggestions submitted, and a 45 percent increase in superior performance awards. A \$12,000 award was granted for outstanding achievements in the protection of fishery resources.

| | | <i>Dollar savings</i> |
|--------------------------------------|--------|-----------------------|
| Number of suggestions submitted..... | 4, 524 | \$2, 482, 095 |
| Superior performance awards..... | 810 | 765, 558 |
| Special act awards..... | 35 | 338, 115 |
| Distinguished service awards..... | 45 | |
| Meritorious service awards..... | 129 | |
| Commendable service awards..... | 329 | |

Division of Personnel Management

Newell B. Terry, *Director*

The recruitment and utilization of professional personnel, principally scientists and engineers, has been of particular concern to the Division of Personnel Management during the past year. Among other activities in this field, a detailed report of the utilization practices of scientific and engineering personnel was made to the Office of Defense Mobilization; and the report was used within the Department as a means of improvement. Special recruitment programs for foresters, engineers, research biologists, physical scientists, and other similar specialists resulted in some improvement in the overall manning for Departmental needs.

Three personnel training conferences were conducted for managers and supervisors as well as personnel specialists. The conferences were held in Portland, Oreg., Denver, Colo., and Washington, D. C. Problems of recruitment, examining, and utilization were stressed under the general topic: "Career Service in the Department of the Interior." A booklet entitled, "Careers in the U. S. Department of the Interior" was published to acquaint college faculties and students with professional employment opportunities in the Department.

The first departmental manager development program for experienced personnel in grades GS-10 through GS-12 was inaugurated. This program supplements the departmental management training program which, for the past 8 years, has trained outstanding young career employees in the lower grades. Twenty-eight trainees success-

fully completed the latter program during the past year. Eight professional student trainee and promotion programs were inaugurated.

Pay-saving legislation and subsequent regulations of the Civil Service Commission necessitated implementation and a complete review of all positions affected. Progress was made in the development of both classification and qualification standards for positions in the Department.

A number of employee grievances and disputes in the labor relations field were settled through arbitration or by mutual agreement through negotiations with the labor representatives of the employees involved. Close relationships with the national and international headquarters offices of labor unions have been maintained and extended through consultations on fundamental labor relations policy proposals.

Under a broad accident prevention program, there has been a noticeable decrease in work injury frequency rates. A motor vehicle safety program was inaugurated and substantial improvements made in the fire loss prevention program. Over 200 safety committees have been organized within the Department and are working to reduce accidents of all kinds.

At the end of the fiscal year, the Department had 56,005 paid employees.

Division of Property Management

N. O. Wood, Jr., *Director*

An outstanding feature of this Division's activities was the completion of a series of four 1-week procurement and supply conferences at strategic locations throughout the United States. A total registration of 392 bureau procurement and supply specialists attended the conferences. In addition, representatives of the following acted as panel members, lecturers, or otherwise participated: (1) President's Committee on Government Contracts, (2) Bureau of the Budget, (3) General Accounting Office, (4) Small Business Administration, (5) General Services Administration, (6) Associated General Contractors, and (7) Workshop for the Blind. The meetings were of the open-forum type designed to insure maximum participation by bureau representatives.

In the contracting field the Division furnished representation on the task force created to carry out the Presidential directive covering

a review of governmental contracting and procurement policy laws and regulations.

Policy and procedure documentation for inclusion in the Departmental Manual was developed for the contracting activity to include chapters on (1) Negotiation of contracts, (2) Nondiscrimination, (3) Escalation, (4) Advance payments, and (5) Small business.

The Division represented the Secretary of the Interior in cooperating with the General Services Administration in the establishment of Government motor pools in nine additional cities.

Action continued in promoting the disposition of major property holdings which are determined to be excess to the Department's program requirements. For example, approval was obtained from the General Services Administration for the transfer of 10,793 acres of land at Fort Wingate, N. Mex., from the Bureau of Indian Affairs to the Department of Agriculture.

In records management, the Division arranged for the training of individuals from three of the bureaus in the technical aspects of forms management; the training was conducted at the Department of the Navy. A complete policy and procedural outline in the field of records management was prepared for the guidance of our bureaus and offices. This outline is documented as a separate series in the Departmental Manual. More than 50,000 cubic feet of inactive and obsolete records were removed from filing cabinets during the fiscal year 1956.

Radio-frequency assignments made to the offices and bureaus totaled 362 for the year; 509 individual station assignments were registered with the International Telecommunication Union. Communication tests were conducted bimonthly in order to maintain the departmental relocation communications center in a state of readiness. Additional personnel were trained for communication duties to replace vacancies and to strengthen the complement of trained personnel available for emergency operations.

Division of Security

J. Cordell Moore, *Director*

During the fiscal year ending June 30, 1957, the Division of Security continued its planning on physical security and civil defense. New regulations covering physical security have been prepared in cooperation with bureaus and offices of the Department. The regulations

have been specifically designed to cover the problems arising from the dissimilar functions of the bureaus and offices.

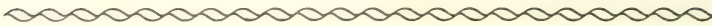
In the civil defense areas, the Department has made contributions of considerable value particularly on the disaster relief program and relocation planning. The disaster relief program under Public Law 875, 81st Congress, might be considered to have passed the planning stage and to have entered the operating stage. The departmental defense liaison officers in the seven civil defense regions have largely completed their initial planning and now have the capability for rendering aid and assistance in case of natural disasters occurring within their region. The types of disasters in which assistance was rendered during fiscal year 1957 included floods, forest fires, and hurricanes. Region III and V, particularly, were called upon and were able to render valuable service in connection with hurricanes and floods which occurred during the year.

The Division participated with other offices of the Department in relocation planning culminating in the annual exercise designed to test the continuity of Government functions.

In the field of personnel security the fiscal year was largely devoted to consolidating and refining techniques and establishing an up-to-date record system. This record system was completed before the end of the fiscal year. A review of sensitive positions has also been started designed to eliminate certain positions from the sensitive category and to add other positions based on the duties of the incumbents. This review has progressed satisfactorily and is scheduled for completion in the first quarter of the 1958 fiscal year.

OFFICE OF THE SOLICITOR

Elmer F. Bennett, *Solicitor*



WORK IN THE Office of the Solicitor during the fiscal year was kept reasonably current. While there were more matters undisposed of at the close of the fiscal year than there were pending at the beginning, approximately 140,000 matters were disposed of during the fiscal year 1957, as compared with approximately 131,000 matters disposed of during the fiscal year 1956.

In March the office of the Field Solicitor which furnished legal services to the National Capital Parks was abolished and the functions of that office were consolidated with those of the Branch of National Parks, Division of Territories, Wildlife and Parks of the headquarters office of the Office of the Solicitor.

To inform the public and to promote uniformity in the application of the Federal Coal Mine Safety Act, a regulation governing appeals of operators to the Director, Bureau of Mines, and a series of interpretations of various provisions of that act, were promulgated as two new subchapters of chapter I, title 30, Code of Federal Regulations.

Twelve patents or inventions developed in the Department's researches and investigations were granted. One of the patents covers the electrical weirs which were installed in a number of streams in the Great Lakes watershed to control sea lampreys. Two others, which have been adopted commercially in the United States and abroad, cover the first successful system of utilizing lignite as an industrial fuel. Another patent covers a well bore caliper now widely used by the petroleum and natural gas industry.

The legislative progress on bills in which this Department is vitally interested proceeded at an easy pace as is usual in the first session of a Congress. However, the number of congressional requests for reports by this Department on legislation introduced during the first session of the 85th Congress substantially exceeded the number of requests received during the first session of the 84th and 83d Congresses as of the close of each fiscal year involved.

There follows a selected list of important cases relating to the activities of this Department decided by or pending in the courts during the fiscal year, of important administrative decisions and of significant opinions of this office. A discussion of cases of especial importance to the Bureau of Reclamation appears in the report of the Commissioner of Reclamation.

United States v. Louisiana, Original No. 15 (U. S. Sup. Ct.). A determination of the respective areas of jurisdiction of the United States and the State of Louisiana on the Outer Continental Shelf off the Gulf of Mexico is sought by this suit. Action by the Court in enjoining further leasing and development except by agreement of the parties filed in the Court resulted in an agreement on October 12, 1956, under which development was resumed, and further leasing made possible in the disputed area. As a result of consideration of the motions of the United States for judgment and of Louisiana for leave to take depositions, the Supreme Court said that in its opinion "the issues in this litigation are so related to the possible interests of Texas, and other States situated on the Gulf of Mexico, in the subject matter of this suit, that the just, orderly, and effective determination of such issues requires that they be adjudicated in a proceeding in which all the interested parties are before the Court." The Court then on June 24, 1957, granted leave to each of the States of Alabama, Florida, Mississippi, and Texas to intervene in the suit, with leave to the United States to file an amended or supplemental complaint adding as parties to the suit any of such States that did not intervene.

Arizona v. California, Original No. 10 (U. S. Sup. Ct.). This case (which is also noted in the annual report of the Commissioner of Reclamation) involves, among other things, claims to rights in waters of the Colorado River by large numbers of Indian tribes and individual Indians. During the fiscal year the preparation and assembling of evidence of the water claims of 27 Indian reservations in the lower basin of the Colorado River was completed by the technical staff of engineers, hydrologists, soil scientists, and other personnel of the Bureau of Indian Affairs who worked under the supervision of attorneys in this Office on this matter. The resultant evidentiary material was furnished to the Department of Justice for use in the presentation of the Government's case before the special master. It is expected that starting in August 1957, testimony of experts who worked on its preparation as well as the evidentiary material itself will be introduced in the case.

Texas v. New Mexico, Original No. 9 (U. S. Sup. Ct.). The Supreme Court on February 25, 1957, dismissed the bill of complaint of the State of Texas, which had sought to require the release of addi-

tional water from El Vado Reservoir in New Mexico, because of the absence of the United States as an indispensable party.

United States v. Union Pacific Railroad Co. (353 U. S. 112). This was an action brought in the District Court by the United States to enjoin the Union Pacific Railroad Co. from drilling for oil and gas on the right-of-way granted to it by section 2 of the act of July 1, 1862 (12 Stat. 489, 491), for the construction of a railroad and telegraph line. The court held that the grant of the right-of-way through the public lands did not convey to the railroad company the title to oil and gas deposits underlying the right-of-way, and that the railroad company may not remove or dispose of such deposits.

Rosedale Coal Co. v. Director of the U. S. Bureau of Mines (No. 7425, U.S. Court of Appeals, 4th Circuit). This decision sustained the actions of the Director, Bureau of Mines, and the Federal Coal Mine Safety Board of Review in classifying the appellant's mine as "gassy," and upheld the methods and procedures of the Bureau of Mines in determining the methane content of mine atmosphere for the purpose of such classification.

Tri-State Construction Co. (64 I. D. 38). A strike precipitated by a contractor's decision to discontinue pay for travel time was foreseeable and hence the appeal to avoid liquidated damages was denied.

Gila Construction Co., Inc. (63 I. D. 378). The Board of Contract Appeals is not authorized to determine an appeal by a contractor in the absence of a finding of fact or decision by the contracting officer, nor to review a determination by the Comptroller General relative to the final settlement of a contract. Information about a contract claim furnished by the contracting officer to the Comptroller General is not a finding of fact or decision within the disputes clause of the contract.

J. D. Armstrong Co., Inc. (63 I. D. 289). Under specifications which called for unclassified excavation, the contractor could expect to encounter a substantial amount of hard material, and, consequently, he was not entitled to an equitable adjustment under the changed conditions article of the contract. Under an approximate quantities provision in the contract the contractor was not entitled to additional compensation by reason of a large overrun in compacted embankment work over the estimated amount of the work indicated in the schedule, when the amount of compaction work actually required conformed to the dimensions and standards prescribed by the drawings and specifications, and the contractor could have computed the amount of compaction work from the drawings before bidding. The contractor has filed a suit in court.

Caribbean Construction Corp. (IBCA-90, June 28, 1957). Claims for additional compensation for the removal of piling, in addition to piling indicated in the drawing and for the laying of a sewer in

extremely adverse soil conditions which should not have been encountered by the contractor in an area described as "dredged fill" were allowed under the "changed conditions" and "changes" clauses of the contract.


United States v. Keith V. O'Leary et al. (63 I. D. 341). In this case although a hearing had been held on charges brought by the Government against the validity of a mining claim under the then prevailing departmental practice, the hearing had not been held before an officer authorized by the Administrative Procedure Act to preside at hearings. The decision remanded the matter for a rehearing to be conducted in conformity with the requirements of the Administrative Procedure Act on the grounds that administrative proceedings in which hearings are necessary in order to satisfy the requirements of due process must comply with the provisions of that act even though there is no statutory requirement that the validity of mining claims be determined on the record after opportunity for an agency hearing. However, in *United States v. Alonzo A. Adams et al.* (64 I. D. 221), it was held that where a contestee does not object to the fact that a hearing officer was not appointed in accordance with the provisions of the Administrative Procedure Act until the case is on appeal to the Secretary, the objection is not timely and does not require that the proceedings be set aside.

Clear Gravel Enterprises, Inc. (64 I. D. 210). Where there are no issues of fact involved and where a claim to public land is null and void on its face and as a matter of law, no hearing is necessary to declare the claim invalid and the provisions of the Administrative Procedure Act do not apply.

Henry Offe (64 I. D. 52). Where a regulation governing the renewal of small tract leases is amended after the issuance of a lease and is not specifically incorporated in the lease, the regulation will be deemed applicable to the lease if it confers a benefit and not an added obligation on the lessee, does not affect the rights of others, and is not detrimental to the interests of the United States.

TECHNICAL REVIEW STAFF

John B. Bennett, *Director*



DURING fiscal year 1957 the Technical Review Staff continued to perform primary staff work in the areas of soil and moisture conservation, watershed protection and flood prevention (P. L. 566), weed control, and related programs. The financial status of the overall soil and moisture conservation program shows that some bureaus have failed to reach the goal set forth in their schedules during this second year of the 20-year period. An attempt is being made to evaluate progress in application and the effectiveness of certain conservation measures. The Technical Review Staff cooperated with the Department of Agriculture in the development of criteria for the national inventory of conservation needs.

The Technical Review Staff has continued to coordinate the review and comments of the Department relative to the watershed protection and flood prevention work plans referred to it by the Department of Agriculture and has assisted in the revision of Agriculture's Watershed Manual as related to the Department of the Interior. The staff is presently engaged in the revision of this section of the Interior Manual.

An analysis of the Federal Range Code, indicating areas of uniformity and variance as related to the Departments of Agriculture and the Interior, was prepared.

A member of the staff is chairman of the Departmental Weed Committee. A proposed chapter for the Departmental Manual on weed control was prepared.

The Technical Review Staff continued to coordinate the forest protection activities of the Department. During the past year, forest fires burned over slightly more than 600,000 acres of Interior lands. Although this is below the 10-year average annual loss of over a million acres, much is yet to be done to prevent man-caused fires and to reduce the total loss from all types of fires. Approximately 900,000 ribes bushes were destroyed in the Department's program

to protect the white pine forests from blister rust. The Department has been maintaining an intensive program for the reduction of infestations and infections within the forests under its administration. During the past year effective action was taken against many pests including bark beetles in California and the southern Appalachians, needleminers in Colorado, and defoliators and mistletoe in the Southwest.

A review of the timber sale policies of the bureaus of the Department concerned with the administration of federally owned or managed forest lands continued during the year. Progress was made looking toward the improvement of timber sale procedures and timber management regulations.

The Lower Colorado River land use and trespass problem has been moved nearer a solution along the lines proposed by the Technical Review Staff, which continues to staff the program. Following a briefing of members of the Arizona and California congressional delegations on the Department's proposal, consultations are now going on with State officials.

In furtherance of its responsibility for the technical aspects of the Department's land appraisal program, the Technical Review Staff is giving attention to land appraisal practices and procedures, organization and staffing, and appraiser training. Considerable progress has been made in raising appraisal standards throughout the Department.

One of the staff of Technical Review Staff was a member of the United States delegation to the Seventh International Grasslands Congress, held in Palmerston North, New Zealand, in November 1956. This Congress was participated in by 36 nations; its purpose was the cooperative exchange of information and technical data on the development and conservation of grasslands among the various countries.

Antarctic matters continued to receive the attention of the Technical Review Staff through its representative on the Antarctic working group of the Operations Coordinating Board. The Department's primary concern is with a resources evaluation program through geologic and biologic investigations and with the processing of a large volume of aerial photography and other mapping data.

The Technical Review Staff was assigned the responsibility of acting for the Secretary on the Interagency Advisory Group which meets at the call of the Executive Director, President's Council on Youth Fitness. In order that the Department's representative may be informed at all times of programs within the bureaus which might have a bearing on the Youth Fitness objectives, an interdepartmental board was established.

Members of the Technical Review Staff have continued to serve as principals or alternate representatives of the Department on several interagency groups engaged in defense mobilization planning, to coordinate certain aspects of the Department's defense mobilization activities, and to provide staff services to the Secretariat in connection with their participation in such activities. Among the interagency groups for which Technical Review Staff provides Departmental representation are the Industry Evaluation Board and the Interagency Advisory Committee on Essential Activities and Critical Occupations. The Technical Review Staff has continued to assemble, for secretarial transmittal, the quarterly and annual reports to the Joint Committee on Defense Production, Congress of the United States, prepared by offices of the Department carrying on activities under the Defense Production Act.

On behalf of the Office of Minerals Mobilization, a staff member of Technical Review Staff coordinated the work of the Bureau of Mines and the Geological Survey in preparing commodity reports for the briefing of the Assistant Secretary for Mineral Resources, on the basis of which recommendations are made to the Office of Defense Mobilization for improving or assuring a mobilization supply. Seventeen such reports on various metals and minerals were reviewed; 14 were prepared for transmittal to the Office of Defense Mobilization by the Secretary. In addition, the Technical Review Staff coordinated the preparation of special reports on other phases of the Department's defense activities, such as the barter of surplus agricultural products for certain metals and minerals.

A staff member of the Technical Review Staff is chairman of the Technical Inter-Agency Power Group which conducts studies to evaluate the adequacy of electric power under mobilization conditions. The TIAPG includes representatives from the Office of Defense Mobilization, Departments of Defense and Commerce, and the Federal Power Commission.

The National Rural Fire Defense Committee, on which the Technical Review Staff furnishes the principal representative for the Department, has reported that State fire defense plans for 34 States and preliminary plans for all FCDA regions had been completed during the year. Attention is being given to the completion of plans for the remaining 14 States and the final plans for each of the regions.

Several staff members participated in Operation Alert 1956.

Continuing operations of the Technical Review Staff include the provision of Departmental liaison with the field committees; with the Bureau of the Budget on coordination of statistical standards, and programing of surveying and mapping; with the National

Science Foundation; and with other Federal agencies on program matters of mutual concern. The Technical Review Staff also provides central staff services in connection with the coordination and direction of the Department's participation in international activities. In addition, staff members worked on numerous special problems which were referred to the Technical Review Staff during the fiscal year.



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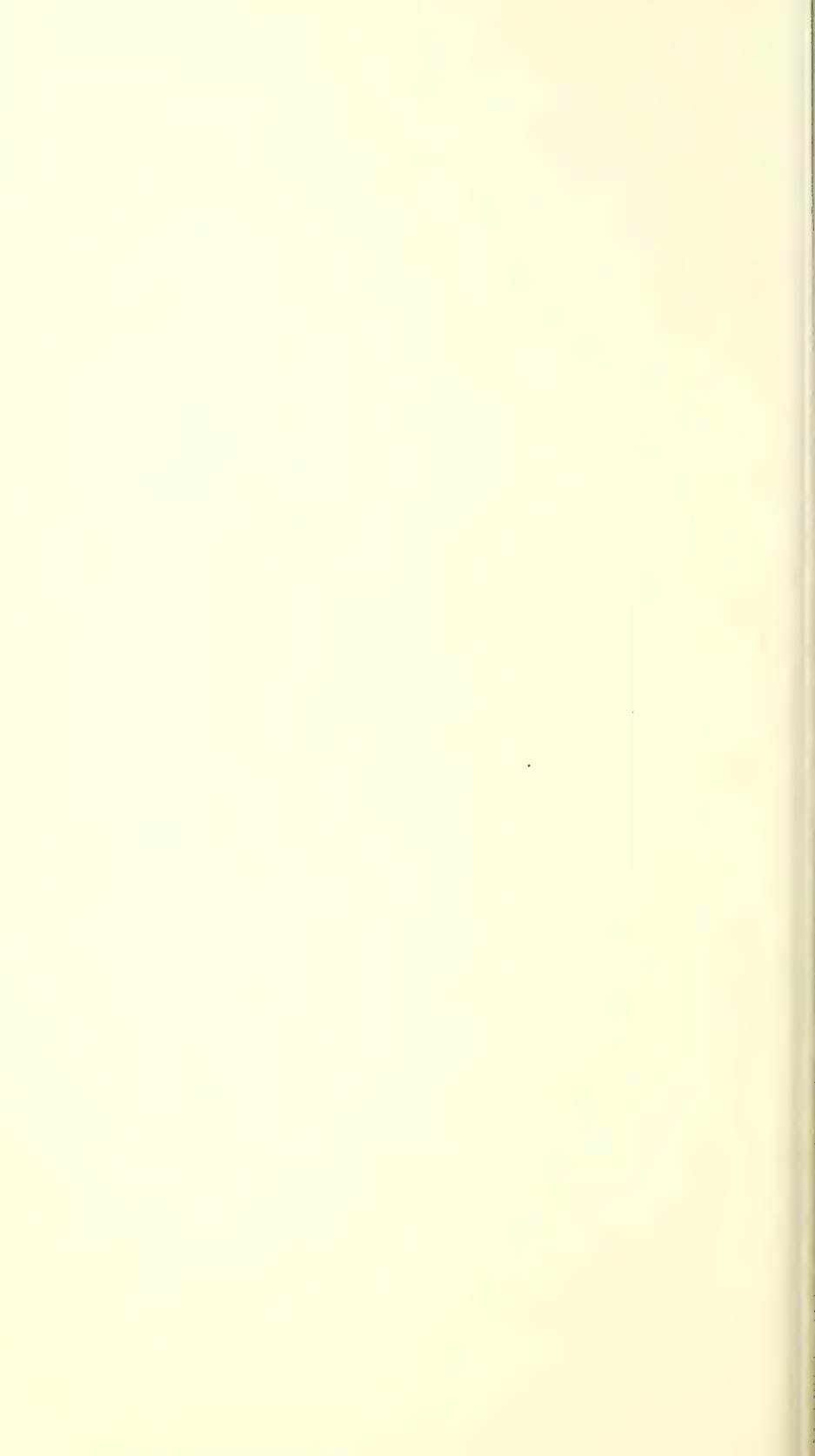
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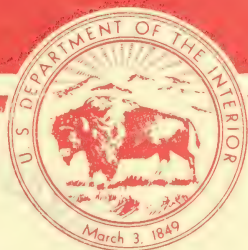
1958 Annual Report

SECRETARY OF THE

INTERIOR

FRED A. SEATON

For the Fiscal Year Ended June 30, 1958



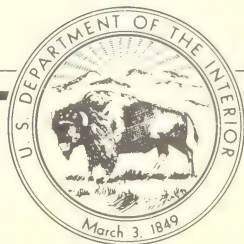
*Sound Use of
Our Natural Resources*

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INTERIOR

For the Fiscal Year Ended June 30, 1958



Sound Use of

Our Natural Resources

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THE SECRETARY OF THE INTERIOR
WASHINGTON

DEAR MR. PRESIDENT: It is a pleasure to transmit to you the annual report of the Department of the Interior for the fiscal year 1958.

This summary of departmental activities has been prepared in the hope that it will serve the cause of conservation by increasing public knowledge of some current efforts to preserve, develop, and wisely use the natural resources of the United States.

Sincerely,

Fred A. Seaton

Secretary of the Interior.

THE PRESIDENT
THE WHITE HOUSE

United States Department of the Interior



Fred A. Seaton, *Secretary*

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PART I

SOUND USE OF
OUR NATURAL RESOURCES



THEODORE ROOSEVELT

*Twenty-sixth President of the United States
Centennial 1858–1958*

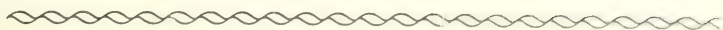
“As a people, we have the right and duty—second to none but the right and duty to obey moral law and of requiring and doing justice—to protect ourselves and our children against the wasteful development of our natural resources.”

*Opening Address, First Governors’
Conference on Natural Resources, 1908.*

“Theodore Roosevelt was a great leader and an impassioned one. Moreover, he was a catalytic leader. He not only made men see, but he caused them to see with vision. He inspired them to become more than just the devoted followers of a leader; he galvanized them into men of action. And so it was with his foresight, with his zeal and zest for conservation. He caused America, as never before, to visualize and actively participate in the drama of conservation.”

*Fred A. Seaton, Secretary of the Interior,
Theodore Roosevelt Centennial Symposium
Lectures, 1958.*

The Sound Use of Natural Resources



TO CONSERVATIONISTS, indeed to all Americans, 1958 was a year of unique significance in the history of the management of our natural resources. It was a year of two historic milestones. One was the centennial of the birth of Theodore Roosevelt, father of modern conservation. The other was the 50th anniversary of the first Governors' Conference on Natural Resources—called by Theodore Roosevelt when he was 26th President of the United States.

In 1958, while the achievements of the past were honored, continuing accomplishments were giving promise that the latter part of the twentieth century would be a golden age in the already brilliant history of American conservation.

To both the achievements and the promise the United States Department of the Interior contributed much.

Sound Use of Wildlife Resources

Nineteen fifty-eight was a great year in the conservation of wildlife.

Under the amendments to the Coordination Act of 1946—sponsored by the Administration—fish and wildlife take on far greater importance than ever before in the planning and construction of Federal dams, reservoirs, and canals. The improvement of fish and wildlife now a specific purpose of Federal water resource projects.

Another historic piece of legislation sponsored by the Administration, the Duck Stamp Act of 1958, earmarks all net proceeds from stamp sales for the acquisition of national wildlife lands, thereby ending the diversion of these funds for other purposes. In effect, at least \$60 million will be available for expansion of the refuge system in the next decade.

The Department of the Interior has also taken steps toward establishing the new Arctic Wildlife Range in Alaska—a nine-million-acre area, nearly twice the size of Massachusetts. This addition will

increase Federal wildlife lands to nearly 27 million acres, the largest total in history.

New stipulations governing oil and gas leasing on these lands have been issued which guarantee full protection of wildlife resources. Leasing is now prohibited in all wildlife refuges in the continental United States except where drainage of oil exists through prior drilling on adjacent lands. On other wildlife lands, leasing will be permitted only where there will be no interference with wildlife conservation.

Sound Use of Mineral Resources

The Department's long-range minerals program was significantly advanced in 1958 when the Department received congressional approval of its long-range domestic minerals exploration plan.

The legislation, as approved by the President, establishes the Office of Minerals Exploration as a permanent bureau of the Department, replacing the Defense Minerals Exploration Administration.

The giant whooping crane, shown here resting at the Aransas (Texas) National Wildlife Refuge, receives special protection from the Federal Government. The species is nearly extinct.





se management of waterfowl resources helps provide hunting opportunities for thousands of hunters every year.

The primary purpose of the new program is to share with private industry the risks involved in carrying out mineral exploration projects which are promising but which would normally not be undertaken with private capital.

A major step forward has been taken in the development of a helium conservation program with the presentation of Department-drafted legislation which would result in the conservation of some three billion cubic feet of helium per year—a vital resource which is now being tragically wasted. Under the program there would be constructed 12 helium-extraction plants, developed by private industry, to extract helium from natural gas before use of the gas for fuel purposes.

The Forty-Ninth State

Congressional approval of statehood for Alaska ranks as one of the most historic accomplishments of the past 50 years. The Depart-

ment of the Interior, long an advocate of Alaskan statehood, is proud of its contributions to this major endeavor.

Alaska—rich in resources of wildlife, timber, petroleum, and minerals—represents in many ways America's last frontier, a land of promise and opportunity. Statehood should bring many dreams to fruition.

The Department, in furthering Alaskan statehood in 1958, opened 20 million acres of public lands for mineral resource development, provided for orderly leasing of oil and gas deposits, and promoted use of timber resources.

The Sound Use of Water Resources

Continuing progress was recorded in 1958 in the gigantic, four-State Colorado River Storage Project through the award of the major construction contracts for the Flaming Gorge Dam in Utah and the Navajo Dam in New Mexico.

Flaming Gorge Dam, to be completed at a total cost of \$66.5 million, is the second largest feature of the project, ranking next to the giant Glen Canyon Dam, now underway. The Flaming Gorge Dam will create a reservoir of 3.9 million acre-feet of water, and will provide 108,000 kilowatts of hydroelectric generating capacity. Navajo, an earth-filled dam, will cost \$42.4 million, and will create a reservoir 34 miles long to provide irrigation water for 115,000 acres of Indian lands.

In its entirety the Colorado River Project, costing a total of \$70 million, will ultimately supply irrigation water for 360,000 acres of land and generate one million kilowatts of hydroelectric power.

The project, when completed, will be the largest single unit in the system of the Bureau of Reclamation, which today provides irrigation water for 7.5 million acres of productive land in Western States.

Desalting the Seas

The increasing water demands of America's expanding population and industry make urgent the development of new sources of fresh water. To provide at least part of the answer to this challenge of the future, the Office of Saline Water of the Department of the Interior, is working to bring down the cost of converting sea water and brackish water into fresh water, usable for industry, agriculture, and human consumption.

Work is now being completed on the plans for a new \$10 million development program to construct demonstration plants to test salt water utilization processes. At least five plants will be built to test



clamation dams provide supplementary water and power for farm, home, and industrial use in 17 Western States.

commercially feasible methods of obtaining fresh water from the sea and other brackish sources.

At the same time, the Department's Office of Saline Water continues to make progress in the search for the keys to converting sea water. For example, pilot plant testing has contributed two entirely new distillation processes and initial studies have been completed in the utilization of atomic energy as a heat source for saline water conversion.

Sound Use of Scenic Resources

Within the National Park System of the United States are some of our most valuable resources—natural, historic, and cultural.

Recognizing this fact, the Department is moving forward under its 10-year Mission 66 program, designed to protect the parks and put them in shape for the millions upon increasing millions of visitors who are coming every year.

With the third year of Mission 66 underway, the accomplishments already are tremendous. Private capital has been encouraged to invest some \$15 million in new and modernized lodges and accommodations. More than 4,000 campsites have been built and improved. There are 17 new visitor centers, and 18 more are being built. Over 200 miles of new and improved roads have been completed or are under construction. In total, some 1,450 new projects are underway in the parks.

Planning for the Future

There are other conservation programs soon to be started.

In cooperation with other Federal agencies, private conservation groups, and foreign governments, the Department of the Interior is planning for a Western Hemispheric Conference on Natural Resources by 1960, a meeting which will carry forward a great tradition begun by Theodore Roosevelt.

The National Outdoor Recreation Resources Commission, a first in conservation history, is beginning its work of reviewing the long-range recreational needs of our increasing number of people. It will present recommendations on how best to meet the recreational needs of the Nation in the year 1976, the year 2000.

Bureaus and offices of the Department are also engaged in a survey of public lands to determine which have greatest recreational significance and which are necessary for proper wildlife conservation purposes.

The Fish and Wildlife Service is putting the finishing touches on a long-range program for the wise use and protection of fish and wildlife resources—similar, in many ways, to Mission 66.

Wise use of Resources

The pages which follow outline in detail some of the ways in which the Department of the Interior is working to promote the sound use of the resources of our section of this continent.

PUBLIC LAND USES

For more than a century and a half, the wise use of the public domain has contributed to the economic and social growth of the United States. From the public domain lands, which once embraced more than 1,800,000,000 acres, the people of our Nation have carved farms, ranches, parks, forests, cities and towns.

Today, the public lands total more than 477 million acres. The Department of the Interior, through the Bureau of Land Management, carries on a wide variety of conservation programs geared to the sound use of this important public resource.

Land Classification

Through land classification, the Bureau of Land Management determines the best present and long-term use or uses for a specific tract. Through adjudication processes, competing rights and privileges of

and use and acquisition are weighed and the lands allocated to their highest use or best tenure.

Classification may lead to disposal of public lands for private development. Or lands may be classified for retention in Federal ownership to meet future resource requirements on a multiple-use basis.

Land Administration

One of the most important programs for sound land use and management is the administration of the large body of the Nation's public land laws by the Department's Bureau of Land Management. Under these laws, over a billion acres of public domain have been transferred to private ownership and local governments.

There are many different laws that apply to the public lands. Some of these, such as the homestead laws and the desert laws, provide means for the transfer of agricultural public lands to private citizens for farms and homes. Other laws permit the public sale, generally by competitive bidding, of certain lands. Another law authorizes the lease or sale of small tracts for residence, recreation, and business uses. Authority also exists for the withdrawal or reservation of certain lands from all forms of public entry and appropriation—for defense, wildlife conservation, and other purposes.

One of the most important parts of the Department's land management program is the maintenance of the official public land records. These priceless documents record the claim of use and ownership of lands that are now or have been part of the public domain.

Public Land Surveys—First Step to Sound Use

Cadastral surveys are the first step in promoting wise use of the public lands. The public land surveys create and identify the boundaries of the public lands and also reestablish old boundaries and markers which have been destroyed or obliterated.

Surveys have been extended over large areas valuable for minerals, including gas and oil, and in the timber areas of the Western States as part of the program for harvesting the mature timber crop. Extensive areas, particularly in California, have been surveyed and subdivided to meet the great expansion of the small tract program in that State. The determination and location of the boundaries of the Federal range land are also a necessary part of the range management program.

The preparation of mineral leasing maps for submerged areas of the Outer Continental Shelf, the resurvey of public land boundaries where old markers and lines have been obliterated, the survey of areas

for settlement (especially in Alaska), and the extension of the public land survey grid over millions of acres of unsurveyed Alaska wilderness and to facilitate mineral exploration and development are all important phases of this vital operation.

Sound Use of Range Resources

Grazing, range conservation, and range improvement programs conducted by the Bureau of Land Management have been planned to further the wise use of range land resources and to rebuild the Federal Range.

Proper inventory of these resources, the adjudication of grazing privileges, and the establishment of grazing allotments are the necessary forerunners to the efficient and sound use of the public range lands. Conservation programs have been closely tied in with grazing land administration to insure perpetuation and improvement of renewable range land resources by providing fencing, water developments, seedlings, and other improvements necessary for proper management.

Range condition-and-trend studies, utilization checks, and range use supervision all are part of the Department's efforts to promote sound range land use and conservation. Establishment of game management units also has enhanced wildlife values and uses on the public domain.

Soil Building

In the soil and moisture conservation program major efforts have been directed toward the development of sound community watershed plans. These plans are designed to improve vegetal cover, provide protection to the soil resources, provide water for wildlife and livestock, and utilize water for forage improvement.

Soil and moisture technicians, assigned to range districts, participate in the planning and construction of retention dams and waterspreading systems to retard potentially destructive and wasteful water runoff and soil erosion. Range revegetation through reseeding and waterspreading protects the soil, increases forage, and preserves important watershed values. This important work is part of a 20-year program begun in 1955 by five Department of the Interior agencies.

In carrying out an active program of rehabilitating depleted range lands and promoting the most effective use of all the public range, range management personnel coordinate grazing activities on a complex pattern of intermixed Federal, State, and private lands. The

Bureau of Land Management also conducts a range improvement program in cooperation with stockmen, including range reseeding, noxious weed control, and the construction of truck trails, corrals, fences, and watering facilities.

Fire prevention and suppression are also taking a major place in the Department's program for the conservation and management of the Nation's range lands.

Sound Use of Forest Resources

Forest lands managed by the Department's Bureau of Land Management are almost equal in size to the State of Texas. Since nearly one-third of the forested lands contain commercial timber, sound management practices are being emphasized in order to achieve the greatest forest use potential.

Forest management objectives of conservation through wise and orderly use are being developed on a sound technical basis. Lands are inventoried in accordance with their forest assets, and by the measurement of representative samples of forest stands.

The data are used to determine the net increase of wood annually, thereby indicating the practical growth of forest resources and the volume of timber which can be removed each year without exhausting the supply. This is the modern-day concept of sustained yield forest management, which treats timber as a perpetually harvestable crop.

Timber cutting is done by private industry, which purchases cutting rights on a competitive basis at public auctions. Timber harvesting is planned and supervised by foresters according to the most suitable conditions. Road locations and conservation practices are specified such as the removal of logging debris, reseeding, and protection of other resources.

While sustained yield timber production is the major use of the forests, there are others. A wise management plan for forest lands must provide for multiple land and resource uses. Thus, in addition to timber, management plans provide for recreation development, wildlife management, watershed protection, erosion control, and protection of the natural esthetic values of forest lands.

Mineral Resources on Public Lands

The mineral resources on our public lands—unlike timber, soil, water, and wildlife—are not replenishable. Once used, they are gone forever.

Our public lands contain valuable deposits of oil, gas, phosphate and other minerals, and the Department initiates, administers, and develops mineral programs on these lands to insure their sound utilization.

The Bureau of Land Management's minerals conservation and development program is designed to encourage mineral exploration and development by private industry through the various mining and leasing laws, such as the General Mining Laws of 1872, the Mineral Leasing Acts of 1920, and the Outer Continental Shelf Act of 1953.

Mineral and mining activity returns substantial royalties and bonuses to the taxpayers through a system of competitive and non-competitive leasing. The Bureau of Land Management, in conjunction with the Geological Survey, supervises lease activities and operations insuring that sound conservation will be practiced.

WISE USE OF WATER RESOURCES

To meet the growing food and water requirements of the Nation, our rivers and streams must be utilized to the fullest possible extent before water is permitted to flow into the sea. As President Eisenhower said in his State of the Union message in January 1958, "The whole matter of our making the best use of every drop of water from the moment it touches our soil until it reaches the oceans, for such purposes as irrigation, flood control, power production, and domestic and industrial uses clearly demands the closest kind of co-operation and partnership between municipalities, States, and the Federal Government."

Wise use of our Nation's water resources is not a simple matter of prudent protection and prevention of waste. Rather, it is a complex problem involving the distribution and use of water for many purposes.

Water Demands Increasing

Two important facts emphasize the inevitability of an increased use of water in the years ahead.

First, our population is increasing at the rate of about two million a year. Census Bureau projections indicate that our country will have at least 220 million people as early as 1975, based on current trends. Furthermore, our population may double again in the second half of the century as it did in the first. A large share of this population increase is expected to occur in the States west of the Mississippi River, where wise use of water resources is essential to survival.



se use of irrigation water turns arid areas into commercially important crop
land producing consumer foods in high demand.



Secondly, despite current crop surpluses, the total acreage of productive agricultural land is decreasing. This trend is expected to continue. Nearly one and one-quarter million acres of good farm land are lost each year to housing, airports, factories, highways, shopping centers, and the like.

By 1975, more than 20 million acres of today's farm land will be used for other purposes, and at the same time our population will have increased by nearly 60 million.

Irrigation Progress

In 1847, the Mormon pioneers undertook the first modern irrigation in the United States. From that beginning, irrigation practices spread throughout the Western States, and by 1902, when the Department's Bureau of Reclamation was formed, about 7½ million acres of land had been placed under irrigation, principally through private initiative and financing.

Today, more than 27 million acres of land are under irrigated cultivation. Approximately 7 million acres receive water from irrigation facilities constructed by the Bureau of Reclamation.

The modern multipurpose reclamation project not only provides water for agriculture but also promotes outstanding benefits in flood control, power, recreation, and fish and wildlife enhancement.

Multipurpose Means Wise Use

Reclamation reservoirs are used to impound spring snowmelt and water runoff which would otherwise go unused and oftentimes cause tragic loss of life and property through flood damage.

Hydroelectric power development at multipurpose dams contributes to the energy supply of expanding areas which would otherwise remain static through shortages of needed power. The recreational use of reclamation reservoirs is another benefit which is often overlooked. More than 12 million vacationists visit these water play grounds annually. In many instances, fish and wildlife values are increased by reclamation developments.

Reclamation Benefits

The progress, growth, and development of the Western United States has been made possible by the wise consumption of water and its planned multiple use. For example, Hoover Dam, completed in 1936, assures a water supply for the great metropolitan area of Southern California, provides important power generation facilities, make

water available for commercially valuable crops, and increases the enjoyment of nature through beautiful Lake Mead.

The Salt Lake City Metropolitan District has contracted for a large share of the water resources being developed by the multi-use Provo River Project in Utah. Other municipalities in Western States are better using scant water resources through storage provided in Reclamation reservoirs. These municipal water users repay the Federal Government in full, plus interest, for the investments made in their behalf.

Current Work

Construction of the vast four-State Colorado River Storage Project is under way, opening a new vista of opportunity in the West. This multipurpose complex will create a productive area of 100,000 square miles from an underdeveloped land which is rich in natural resources. Water and power will provide opportunity for industrial development and agriculture, contributing to the progress and growth of cities and towns in Colorado, New Mexico, Utah, and Wyoming.

In total, projected construction schedules provide for multipurpose reservoirs which will impound 58 million acre feet of currently unused water—enough to supply irrigation needs for more than 1½ million acres. Preliminary studies are nearly complete for the Garrison Diversion Unit on the Missouri River, which will carry water to more than 1 million acres in North and South Dakota.

Completion of the Trinity Division of the Central Valley Project in California will make available an additional 1,190,000 acre-feet of water for presently irrigated lands.

Finally, a comprehensive analysis of Texas water-use requirements has been outlined, and a broad program to meet these needs is being developed.

Water Conservation

Development of better water-use practices is carried on in many additional ways. For example, experiments are being conducted to develop a practical and economical "chemical shield" to reduce evaporation losses from lakes and reservoirs. Today, Western reservoirs lose between three and eight feet of surface water each year through evaporation, and laboratory studies indicate that it may be economically feasible to save up to 30 percent of evaporated water without harmfully affecting human or aquatic life. Other experiments such as weed control programs to eliminate salt cedars and other water-wasting vegetation, are being carried forward to increase use of existing water resources.

Power Benefits

Hydroelectric generation of power is a valuable byproduct in the efficient multiple use of water resources. In the Northwest, the Department's Bonneville Power Administration supplies well over half of the electric power requirements of the Columbia River Basin. The BPA makes possible the electrical integration of both public and private power generating facilities through its high-voltage grid which forms the backbone of the voluntary Northwest Power Pool.

In other parts of the country, the Southwestern Power Administration and the Southeastern Power Administration further the sound use of water resources through power marketing, integration, exchange, and planning of power development, in accordance with the power needs and practices of each region.

Looking Ahead: Saline Water Conversion

One of the most inspiring scientific investigations underway today is that which will lead to the successful development of commercially feasible methods of desalting the oceans and seas. Progress in the conversion of saline water will bring new benefits to this country and to underdeveloped areas throughout the world. Successful desalting of water will, in many respects, fulfill the ancient dream of the flowering of the deserts of the world.

America's Contribution

In this country, it also has become evident that many parts of the Nation will, in future years, turn to the oceans and other sources of brackish water to meet their growing water needs. Therefore, the Department of the Interior, through the Office of Saline Water, conducts a research and development program to develop economically feasible methods of desalinization of water.

Since the initiation of the Saline Water Program in 1952, progress has resulted in a several-fold reduction in the cost of converting salt water to fresh water. This progress has resulted from determined work and progressive reductions in costs, rather than through so-called breakthroughs. Continued progress is expected along the lines of past achievements, and many scientists believe that the development of successful methods of saline water conversion is principally a matter of time.

Multiple Approach

To promote the use of saline water resources, the Office of Saline Water has moved forward as rapidly as technology and congressional

appropriations would allow. Primarily, the effort has been made to coordinate and stimulate activities among interested public and private groups rather than develop extensive Federal laboratory and testing facilities.

Federally financed grants and contracts have been entered into with industrial research organizations, universities, research institutes, and private firms. The Department has also promoted studies by the Bureau of Reclamation and the Bureau of Standards, as well as other municipal and public bodies. In addition, cooperative agreements for the exchange of information and participation in joint development work have been undertaken with private firms which are independently working on saline water conversion. When the technical barriers are finally surmounted, sea water will be converted by many different kinds of apparatuses ranging from small household mills to large municipal and industrial plants.

Geologic Water Studies

The people of the United States are now using about 1 gallon out of every 5 that is potentially available to them.

Water shortages stem more from poor distribution than from an inadequacy of the total amount of water which each year falls on the United States and runs off to their oceans.

The sound use of water resources requires, more and more, new and improved knowledge. We need to know, for example, the details of what happens when intermediate and low-level radioactive liquid wastes are ponded on the surface, or injected into the ground. Disposal of radioactive wastes by ponding in lagoons and injection in wells already has been practiced for several years. How long will these methods be satisfactory?

We do not currently know enough about diffusion and dilution in ground water and surface streams to give a realistic answer.

The problem of stored high-level waste has even greater long-range importance. Each reservoir of highly radioactive waste is a potential threat of serious and long-term contamination of the water resources of an area because the waste could be released at any time by leakage, accident, sabotage, military attack, or seismic damage. Should any such waste be released, the immediate problems would be how to immobilize it, how to predict where it would go if it moved, how to trace its movement, and how to calculate interactions between the waste and the geologic environment. To solve these problems, we need to know more about the fundamental principles involved in the motion of ground water, the behavior of water as it first enters the ground, the diffusion in surface streams, the movement of sediment



Geologic information developed by the Geological Survey of the Department of the Interior aids in the scientific search for new sources of vital mineral resources.

streams, and ion exchange. Where wastes may be discharged or escape into the environment, we need to know in detail the geology, hydrology, and physical and organic chemistry of the area. The need for accumulation of radioactive wastes emphasizes the need for accelerated study to develop more knowledge and more thorough understanding of this problem and its solutions.

MINERAL RESOURCES AND THEIR USES

Coal, petroleum, metals, and nonmetallic minerals are deposited in the earth at rates so unbelievably slow that these resources are considered to be non-renewable.

At the same time, minerals are increasingly important to American industry and consequently to the national security and standard of living of the American people. In the circumstances, it is essential that we do everything possible to further the development and efficient use of mineral resources, to assure that the greatest possible value is extracted from every ounce of our minerals and fuels.

Long-Range Minerals Program

During June of fiscal year 1957 the Department presented a long-range minerals program to the Congress. The essentials of the program involved an acceleration of those activities, such as topographic and geologic mapping, which must precede and supplement private exploration; an expanded program of Government research and development work; the maintenance of a fiscal climate that encourages private initiative in minerals development; and the stimulation of intensive search for new commercial deposits.

When no action was taken on its proposals, the Department developed and presented a revised program to the Congress in April, 1958. During the preceding year, there had been sharp declines in the prices of several metals—notably copper, lead, zinc, and some other metals—declines which hampered minerals production in this country. In order to alleviate this situation, the Department requested the enactment of legislation which would authorize stabilization payments to producers within distressed segments of the mining industries.

In addition, the Department requested funds to permit immediate acceleration of research and development activities carried out by the Geological Survey and the Bureau of Mines. The Department also placed new emphasis on the need for authority to continue a program of financial assistance to private industry in minerals exploration projects.

Better Helium Utilization

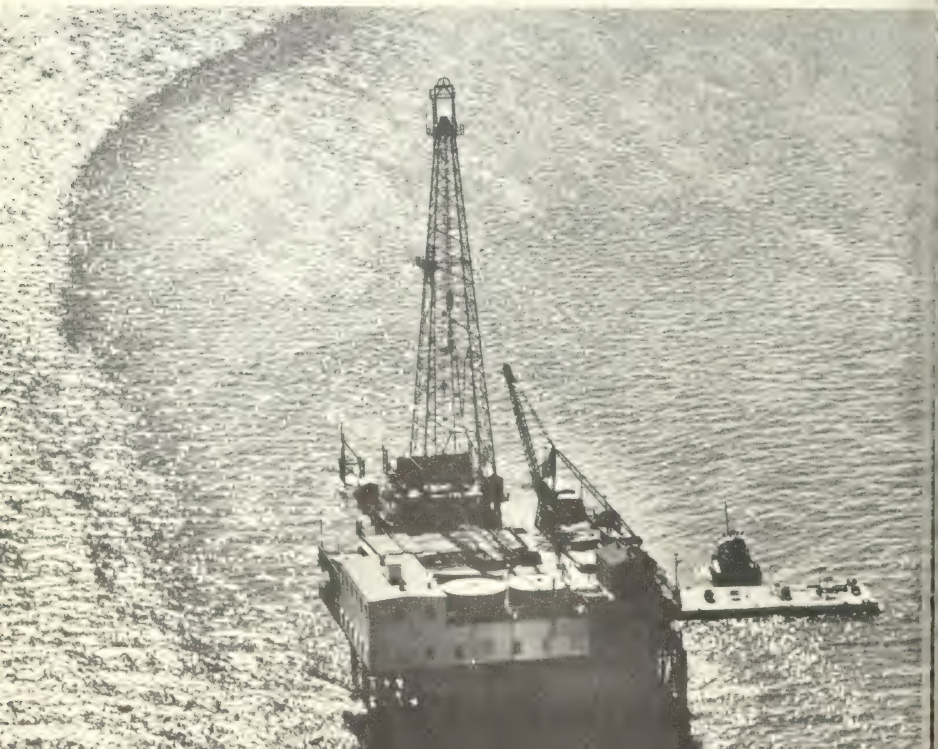
As an example of how a product of great value can be wasted, consider helium. This lightweight, inert gas is vital to missile and atomic energy programs, as well as other Federal, industrial, medical, and research activities. It possesses many qualities which cannot be duplicated.

The Nation's total supply of helium is produced by the Bureau of Mines at four plants located in Texas, New Mexico, and Kansas where 340 million cubic feet were extracted last year. This amount, however, contrasts sharply with the estimated 3 billion cubic feet of helium wasted last year when helium-bearing natural gas was used as fuel because helium extraction facilities are lacking.

To cut this waste, the Department of the Interior is seeking legislation which will make it possible to carry out an effective long-range helium conservation program in cooperation with private industry. This new conservation effort entails the construction of 12 new helium processing plants, located on helium-bearing natural gas pipelines, to extract helium from the gas before it goes to market.

Success will mean an end to current wasteful practices.

Energy requirements of the Nation require that fuel resources, wherever found, be developed and utilized by a growing America.



rare Metals

The production of lesser known and hyper-pure metals well explains the need for more intelligent mineral processing and the expansion of new uses for metals.

Zirconium ore, for example, contains a rare metal called hafnium which must be removed in order to process high-grade zirconium. Finding uses for hafnium's unique properties is a subject of current research. Gallium, another lesser known metal, must be separated in the processing of highly pure aluminum. We are long on gallium supplies but extremely short on uses.

No one can predict, however, how long there will be such a slight demand. Unusual programs, such as atomic energy or missile research, have in the past required unusual minerals with unique qualities. And whenever such a new demand comes into existence, another substance is often saved from the waste pile.

Geologic Resource Mapping

The Department's responsibilities in the stimulation of minerals exploration include geologic mapping and studies in related theoretical and applied science by the Geological Survey.

Effective utilization of our mineral wealth requires the collection and interpretation of geologic data which will assist in the discovery and appraisal of untapped mineral resources.

In the face of expanding population and unprecedented defense needs, geologic mapping and related research in the earth sciences have greatly increased our knowledge of the Nation's mineral resources.

Rapid advances in new geologic technology and tools have been made in recent years. Many of these advances—portable seismometers, geochemical and geobotanical exploration techniques, and modern applications of photogeology—were pioneered by Geological Survey scientists.

Topographic Mapping

Because the intelligent use of resources involves a continuing relationship between men and the land, the National Topographical Map series prepared by the Geological Survey is of particular value. These maps, which are complete portrayals of the terrain and the works of man in any given area, provide valuable information on the possibility of resources—information essential in resource exploration and development.

Without efficient mapping services, the sound use of water, minerals, forests, and soil, as well as the preservation of scenic areas and wildlife refuges, would be infinitely more difficult.

Minerals Exploration

Because our Nation's mineral requirements are increasing at a rapid rate, an aggressive minerals exploration program becomes an increasing necessity.

The Department of the Interior, through the Defense Minerals Exploration Administration, has conducted since 1951 an exploratory program for strategic and critical minerals needed for national defense. Because strictly defense mineral goals have been achieved, the Department has obtained legislation to continue the minerals exploration program on a permanent basis.

The establishment of this permanent minerals exploration program in the Department as a cooperative venture with private industry will continue to provide an effective and efficient method of developing sources of mineral reserves, adding to the wise use of these resources for the benefit of present and future generations of Americans.

INDIAN RESOURCES

The Department's concern for the sound use of Indian natural resources is a direct outgrowth of its trust responsibilities, exercised through the Bureau of Indian Affairs, for thousands of Indians and 52,000,000 acres of Indian land, located principally west of the Mississippi River.

Approximately three-fourths of this land, although held in Federal trust, is classified as "tribal land" and is the private property of Indian tribes. The remaining quarter, called "allotted land," belongs to individual Indians. The pattern of ownership, in short, is extremely complicated, and this fact serves to heighten the problems which the Bureau of Indian Affairs must face in administering its trust responsibilities with respect to resource management and use. Roughly half of the allotted tracts are held either by the original allottees or other single individuals; the other half are in multiple ownership as a result of inheritance. While a majority of the "heirship" tracts are owned by two to five individuals, a substantial number are owned by six or more, and some are the joint property of literally dozens.



se utilization of Indian resources for and by the Indians is the goal of the Department of the Interior.

Range Resources

From the standpoint of use, by far the largest portion of the Indian lands—some 32,000,000 acres—is classified as open range and is used principally for the grazing of cattle or sheep. While much of this land, particularly in the Southwest, is used by individual Indians or Indian livestock associations, a substantial portion has been organized into range units and is leased, under a permit system, to both Indians and non-Indians.

As trustee, the Bureau of Indian Affairs is responsible for administering these range units. Its principal aim in range management is to develop and maintain a pattern of use which will (1) protect and conserve the basic forage resources, and (2) provide the maximum economic return to the Indian landowners consistent with the conservation objective.

Forest Resources

The second largest category of Indian lands from the use standpoint is that of forest lands, which total some 16,000,000 acres. Of these, between 5,000,000 and 6,000,000 acres are classified as commercial woodlands.

These forests provide many things: timber for industry; forage for livestock; fish and wildlife habitat; recreation opportunities for the vacationer. Within them are the fountainheads of many streams and rivers that supply water for farms and cities.

Sound use of the Indian forest, therefore, is multiple use, with the goal of returning the greatest possible benefit to the Indian owners and tribal communities.

For many years, the most important objectives of Indian forest management were to produce timber products to full sustained yield capacity and also to develop and use grazing values to full capacity.

There is no reason to believe that these will become subordinate to other uses. Today, however, there is a steadily increasing emphasis on concurrent use—development of other values. Increasing populations require increasing volumes of water—water available and needed. Control of water starts at the headwaters of streams, in the forests; and forest management practices affect water flow. Increasing populations also require more space for relaxation, and forest management practices affect recreational values.

Effective forest management begins with an inventory of forest resources and characteristics. Rapid progress is being made in the field of forest inventory on Indian lands, and sound plans for multiple use are being put in operation.

Agricultural Resources

In addition to the range and forest lands, about 3,800,000 acres of the Indian lands are currently being dry farmed either by Indians or by non-Indians under lease, while some 870,000 acres are under irrigated cultivation.

The wise use of the Indians' natural resources of soil and water is dependent upon a knowledge and understanding of modern agricultural practices. Although management of these lands is still Federal responsibility, the Department encourages the Indians to prepare for eventual assumption of full responsibility and authority. A properly balanced Indian program giving consideration to physical, social, and economic factors is a prerequisite to the optimum utilization of the Indian lands.

Through resource inventories started in 1957, the Department collects basic physical data for each reservation. This information will

new kinds and amounts of soil and plant resources. Used in conjunction with available social and economic data, this information will contribute to the Department's planning for wise use of natural resources. It will provide a foundation upon which an educational program, to develop Indian knowledge and understanding of these natural resources, can be built. Such a program is an essential requirement for future resource use and development programs based on the assumption of full responsibility and authority by Indian people.

Mineral Resources

Mineral production on Indian land is undertaken by private industry under prospecting permits of various types and standard leasing agreements. Exploration of potentially mineral-laden areas is essential if the Indians are to receive full benefit from use of their natural resources. Indian tribes and individual Indian landowners are therefore encouraged to lease their land for mineral development with a view to obtaining the maximum exploration, development, and income consistent with sound conservation. Mining leases contain more stringent provisions than those common to the business world, to insure sound conservation practices and fulfillment of the Government's trust responsibility to the Indians.

Realizing the irreplaceability of their mineral resources, Indians and landowners are strongly interested in the joint efforts of the Government and industry to obtain efficient operation, eliminate wasteful practices, and protect the correlative rights of landowners and operators. The Indian landowners' interest is primarily in nonwasteful production for use. The Geological Survey joins with the Bureau of Indian Affairs in responsibility for royalty accounting, supervision of field operations, and application of rules to prevent waste and promote conservation.

For example, these two agencies strive to encourage the greatest ultimate recovery of oil and gas through unit operation of leases and application of the most advanced methods of secondary recovery. The present well-organized system for production of oil and gas is regulated to assist in orderly, nonwasteful, and equitable production; this system results from long years of coordinated efforts by the petroleum industry, oil and gas-producing states, and the Federal Government. Although State regulatory agencies generally do not have jurisdiction over production from Indian lands, the Department recognizes that the conservation of petroleum resources in Indian lands constitutes an integral part of the States' conservation problem, making cooperation and coordination with State authorities essential.

Sound use of other minerals is gained through supervision of field operations by the Geological Survey, unitization of leases, and suspension of operations based on market conditions.

Human Resources

American Indians are encouraged to develop and use their individual capacities either within their tribal organizations or as individuals living on or off the reservation. According to their personal qualifications, they may hold any type of employment, private or governmental. To help the Indian attain his highest potential, the Federal Government provides assistance to: (1) raise the Indians' educational standards through the provision of more and better schools; (2) improve their health through better medical and hospital services (through the United States Public Health Service); and (3) better their economic and social conditions through the stimulation of new job opportunities in agriculture and industry.

Over half the Bureau's annual appropriation each year goes for reservation schools for the Indians or for payments for their education at nearby State-supported schools. The remainder goes for a dozen other services such as adult education, relocation services, land management, soil conservation, irrigation, forestry, roads, and welfare. This is the Bureau's major responsibility—the fostering of conditions which will stimulate and encourage the Indian to develop his own human resources. It is against this background that the systematic development and conservation of his natural resources—his land, livestock, and forests—proceed.

TERRITORIAL NATURAL RESOURCES

With the exception of our former territory and newest State, Alaska, this Nation's territorial possessions are island areas. Some like Hawaii, enjoy an advanced stage of economic development and efficient resource use as States of the Union. Others, such as the Trust Territory of the Pacific, are so meagerly supplied with natural resources that mere survival presents a problem to local populations.

As a result, Federal assistance to our territorial areas, extended in many cases, not only to conservation efforts but to the active promotion of the growth of free economic and political institutions.

Federal Activities

Federal economic assistance has developed essentially in the fields of transportation and public works. Thus, the Department of the Interior, through its Office of Territories, owns and operates the

Alaskan Railroad and provides directly—or through private contractors—many of the transportation facilities in the Trust Territory of the Pacific Islands. The territorial public works program, totaling \$70 millions in fiscal 1958, is also financed by the Federal Government and has been planned to promote the effective use of local resources.

In stimulating business enterprise, the Department has taken effective steps to bring private industry into resource development. In past years, much of this activity has taken place in Alaska, and it has helped this area's advance to statehood.

A new and modern wood pulp industry has been brought to Southern Alaska, for example, through the establishment of a large and successful plant at Ketchikan. The coastal forests of Alaska, stretching to the Kenai Peninsula, constitute one of the greatest virgin stands of timber in the world; for years these forests have been left undeveloped.

Mineral Utilization

The Department has also encouraged the development of oil and gas resources in Alaska—on the Kenai Peninsula and in the northern reaches of Alaska beyond the Arctic Circle.

The proved deposits in Northern Alaska are substantial. The oil strike on the Kenai Peninsula is encouraging, but the extent of the recoverable reserves has not yet been determined. Even lacking such confirmation, exploration and development efforts have led to oil and gas leasing activities which now embrace millions of acres of Federal lands in many parts of Alaska.

The great hope of Alaskans today is that wise use of Alaskan mineral resources will insure the economic health of the Nation's newest State. The Department of the Interior is proud of its role in actively improving the resource potentials of Alaska when it was a territory and of its part in effectively advancing Alaska to statehood.

Isular Development

While cooperative development and effective use of natural resources may seem less spectacular in other Territorial possessions, the efforts of the Department have been equally important and have provided a spark to progress.

In the Virgin Islands, the Virgin Islands Corporation's program in electric power, sugar and agriculture generally has, with tourist and recreation developments, bolstered the local economy.

Fresh water has always been a problem in the Virgin Islands. This year a program of building water-catchment basins has continued. Beyond this, the Virgin Islands can look forward soon to construction of a desalination plant for the conversion of saline to fresh water which may solve one of the islands' most pressing resource problems.

In the Pacific, resource use programs extend from Hawaii to American Samoa through the Trust Territory to Guam. The operation of a fish cannery under private auspices but with Federal territorial encouragement has become a major Samoan enterprise. In the Hawaiian Islands the Molokai irrigation project, after study by the Bureau of Reclamation, is under construction by the Territorial government.

In the Trust Territory of the Pacific Islands, coconut groves are being replanted and cacao plantations developed. A project for subsistence fishing in these islands will not only add greatly to the importance of this food resource but may eventually develop into a small commercial fish cannery in the Palaus.

Self Government—The Goal

Over all these programs for resource utilization are the Department's broader and even more fundamental plans for encouraging the evolution of free political institutions. This has brought Alaska to statehood with Hawaii likely to follow.

In those Territories where statehood may not be the natural objective of political maturity, the Department's programs have brought in increasing measure, the opportunities, the rights, and the duties of self-government.

WILDLIFE RESOURCE UTILIZATION

Fish and wildlife—which mean both food and recreation—are often the first victims of faulty conservation practices. Conversely, when conditions which adversely affect fish and wildlife values are corrected, other important resource-use programs are furthered.

For example, while the nonhunter may be disinterested in the abundance of game, the existence of wildlife generally means ground cover which protects a watershed. A depleted trout stream often indicates faulty soil conservation and land management. Lands stripped of timber and improper farm practices not only destroy trout spawning beds but also mean that fertile topsoil needed to maintain human life is being washed away and wasted.

Air pollution, harmful to fish, also limits the value of a stream for human consumption, industry, and recreation. In many cases, it s



se use of fishery resources provides food for America's tables and countless hours of wholesome recreation.

ocal sportsman's organization which sets in motion efforts to clean rivers and streams. Hunting pressures have many times brought out the reexamination of resources, and the quest for cottontail and quail has often clearly shown private landowners the importance of soil conservation.

Proper Planning Important

The practical problem of oil and gas leasing on Federal wildlife refuges and lands, plus the possibility that the conservation of wildlife might forestall utilization of valuable mineral resources, has led to the establishment of clear-cut guidelines by the Department which will permit oil development and yet insure maximum protection for wildlife resources.

Conservation principles, however, apply to the high seas as well as to land, and to international as well as national conditions.

The plight of the Atlantic salmon fishery, for instance, is a story of a century of exploitation based on the belief that resources are endless. Despite the fact that perpetuation of the species depends on successful spawning, dams were constructed without consider-

ing this problem. Finally, stream pollution completed the task of reducing this great resource to a pitiful fragment.

However, planners of the Columbia River Basin development undertaken primarily for irrigation and power, recognized the importance of the fish and wildlife resources. Therefore, extensive and continuing efforts were introduced to retain the fish and game potential which otherwise would be sacrificed.

Another example of conservation efforts directed toward wise use is seen in the Pacific salmon study which involves three nations and half an ocean. Painstaking research based upon serology and parasitology has developed ways of differentiating between American and Asian salmon stocks. Equally difficult research based upon systematic tagging and recapturing of fish is under way in the areas of the ocean in which the western and eastern salmon strains spend their marine portion of their lives. Studies of the areas of intermingling will form the basis for new rules of harvesting the resource so that each salmon strain can be managed to insure a maximum annual yield.

Wise Use Means Many Things

Conservation is also a laboratory product. The "education of the mouse" technique, for example, developed by the Fish and Wildlife Service, makes seed-eating rodents ill without destroying them, thereby cutting many years off the time formerly needed to rebuild a forest.

It was in the laboratory that the selective poison which will kill destructive lamprey larvae but not injure fish was discovered after 5,000 trials, and it was laboratory experiments that developed the electrical units which trace the movements of fish, count them, and guide them past intake openings at hydroelectric facilities.

When research also determines the reason the populations of some food fishes fluctuate so violently, another milestone in conservation will have been reached.

Cooperative Effort

There is a trend toward Federal, State, and local cooperation to complete more work and expend funds more efficiently in the common task of conserving fish and wildlife.

Cooperative studies have been undertaken on deer diseases by the Southeastern States. Factual information on the harvest of deer and antelope has been collected by four Western States. Common projects were organized on prairie chickens and coturnix quail by many Midwestern States. The striped bass of eastern coastal streams

are studied by a cooperative project among the Middle Atlantic States. Research information on important salt water game fish is collected by six Northeastern States and pooled for mutual benefit.

Timber and grazing improvements on United States Forest Service and Bureau of Land Management lands were undertaken by the Western States for the benefit of game animals with the active help of the Federal agencies.

Cooperation in wise use of resources is evidenced again in the complex checkerboard pattern of public and private land in the West and under the more intensive agricultural practices in the East, where predators or rabid animals are controlled by the united efforts of officials, agriculturalists, and sportsmen—and where “to control” means to limit the numbers of a species but not eradicate it.

The Fish and Wildlife Service also cooperates with the Bureau of Reclamation, the National Park Service, the Agricultural Conservation agencies, the Corps of Engineers, the Federal Power Commission, and with various organizations representing sport fishing, commercial fishing and wildlife.

Still another example of the teamwork pattern is the cooperative approach being taken by the Fish and Wildlife Service and the various State fish and game departments to solve migratory waterfowl problems. By setting up Flyway Councils, coordinated management by the Federal and State agencies has been established to insure protection and restoration of waterfowl and at the same time provide for a sustained hunting of birds by the public.

Conservation Insures Wise Use

As long as salmon run, there is evidence that not all the spawning beds have been gouged out by logging, silted over by mining, or recovered by reservoir developments.

As long as our fishing vessels continue to operate successfully in coastal and inshore waters, there is evidence that the estuarine and other spawning and rearing areas have not been sacrificed to other uses.

As long as commercial fishing grounds continue to yield their harvests on a sustained basis, there is evidence that international conservation is still effective.

As long as fish jump in the river or dart to and fro in the pond, as long as the hunter can come home with a pheasant, woodcock, brace of ducks or a cottontail, as long as elk and deer are seen roped over the fenders of home-bound cars each fall, there is evidence that natural resources are being wisely used by our people.

INCREASED USE OF NATIONAL PARKS

Nearly every American would agree that people should have a chance to pause now and again and enjoy the superlative beauties of the earth and water of their native land; that they should be able to find pleasure and inspiration in the great outdoors, away from the pressures and worries of the everyday world; that they should have opportunities to view the great memorials of their historic past and to understand and to appreciate their national heritage.

So an important part of America's land—important because of outstanding scenic, scientific, and historic values—has been set aside under the jurisdiction of the Department of the Interior's National Park Service, to be preserved for the benefit and use of the American people.

Extensive Park Development

Since the first national park—Yellowstone—was established in 1872 “as a public park or pleasuring ground for the benefit and enjoyment of the people,” the intervening decades have seen the establishment of others, similarly marked for public use. Concurrently other kinds of nationally significant areas have been brought into the National Park System—national monuments, historical reservations of various types, early battlefields, a national seashore recreation area, and national parkways.

Today, the Department administers 180 areas, including 29 superlatively scenic national parks, 83 national monuments of scenic, scientific, and historic importance, and other types of reservations. These areas cover some 25 million acres. Comprising less than 1 percent of the United States and its Territories, the importance of the acreage in the Park System lies not in its physical size but in its important place in the American scheme of things.

All of the reservations within the National Park System are part of the cultural and recreational heritage of the American people. They not only conserve important natural resources for public use, but also constitute inspirational, historical, archeological, and educational resources for the benefit of present and future generations.

The Department's administration of the parks, through its National Park Service, is, therefore, governed by the two basic principles of conservation and sound use. These principles were clearly defined in the Yellowstone Park Act of 1872; they were reemphasized when Congress established the Park Service in 1916: “To conserve the scenery and the natural and historic objects and the wildlife there-

and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Increased Use of Parks

Though the parks were adequately preserved and developed to care for the 21 million visitors of 1941, for example, no one anticipated even the tremendous surge in park use since the end of World War II. Nor were the problems inherent in attempting to conserve the priceless park resources, while making them available to the spiraling mass of millions of visitors, foreseen at that time. The 21 million visitors in 1941 became 33 million in 1950, 46 million in 1953, more than 50 million in 1955, 55 million in 1956, and almost 60 million in 1957.

There are many reasons for this astounding increase, including the rapid economic growth of the Nation, and the expansion of its population to more than 175 million people—people with increased opportunities for leisure. Our people increasingly have become a traveling, sightseeing people, intent on knowing and enjoying the scenic and historic places of their country.

Expansion of Park Facilities

How is the Department coping with these trends? How can it protect the priceless park features, provide the necessary facilities for this rapidly growing park visitation, now expected to reach more than 60 million a year in the next 5 years? How can it assure enjoyable and satisfying experiences in the scenic, wilderness, and historic areas of the National Park System to these visitors?

The answers lie in the plans and goals of an integrated program called Mission 66. This dynamic, long-range program—aimed at full protection and adequate development of park resources by 1966, the 50th anniversary of the National Park Service—completed its second year of operation on June 30, 1958. With this program essentially on schedule, accomplishments have been impressive and substantial. Before the launching of Mission 66, in July of 1956, the Department was seriously concerned that the parks might become crowded and overused, and that their capacity had become impaired to provide the rest, relaxation, and inspiration for which they were established. The problem, at that time, was that the parks were neither equipped nor staffed to protect their irreplaceable features, nor to take care of the increasing millions of visitors. Accommodations were inadequate, unimproved, and many of them in a state of disrepair. Roads designed for another travel era were clogged with automobiles. Park lands

were becoming worn and abused because of the crowding of people beyond the capacity of lodges, campgrounds, roads, and trails to serve them. Natural features were being vandalized, and worn away by impact. Visitor enjoyment was impaired by too many people crowding to the same place at the same time.

Mission 66 Progress

Under Mission 66, the scene has been changing, and the future, pointing to the program's completion in 1966, looks bright. As accomplishments in the past two years, some 1,500 Mission 66 projects were completed or under construction in various park areas by the end of the 1958 fiscal year. These represent a capital investment valued at more than \$110 million. Of that amount, some \$37 million was spent on facilities that were completed and in use by visitors in the 1958 summer season.

Added impetus was given to the Mission 66 program in the last months of the fiscal year when new contracts, amounting to almost \$34 million, were let under the Administration's accelerated public works program. During that period, some 20 major road contracts were let in 15 national parks and the National Capital Parks at a cost of almost \$9 million. Another \$9.8 million was awarded for major work on four national parkways—Blue Ridge, Natchez Trace, George Washington Memorial, and Colonial. For buildings, utilities, minor roads, and trails, more than \$15 million in additional contracts was awarded. Thus, construction of additional visitor centers, campgrounds, trailer courts, picnic sites, utility systems, improvements to park roads, and other work has been accelerated in addition to the dramatic results achieved in the first 2 years of Mission 66.

Complete Park Improvement

The "package" approach to park development, used for the first time under Mission 66, shows tangible evidences of better and more adequate visitor accommodations and services. This new concept of development provides for concentrated construction of needed facilities in large units within park areas, then moving on to others.

For example, when a road is built, the lodges, campgrounds, public use buildings, utility systems, and other facilities to which the road leads are completed and ready for use at the same time. Because construction is programmed, financial savings accrue from purchased materials and equipment in larger amounts, less disruption of visitor services results, and it becomes possible to provide usable facilities in a shorter time.

In such developments, particularly in and near the large, scenic national parks where overnight accommodations and other services are essential for full public enjoyment of those areas, private enterprise works in harmonious cooperation with the Federal Government providing concessionaire-operated facilities. Under Mission 66, private enterprise has so far invested more than \$15 million in sorely needed new accommodations such as lodges, motels, and cabins, and has completed other new and improved park-use facilities, including cafeterias, stores, service stations, and curio shops.

Among the completed "package" projects, the development at the new Canyon Village site in Yellowstone National Park is one of the most impressive. There a new lodge, cabins, campgrounds, trailer court, visitor center and museum, store, service station, and other facilities were in use at the end of the fiscal year; overnight accommodations are available for nearly 4,000 visitors. Completion of that project will make it possible to raze the old lodges and cabins from the rim of the Grand Canyon of the Yellowstone and to start restoration and preservation of the scenic lands for the esthetic enjoyment of the visiting public.

True Meaning

Though all of the improved facilities, new developments, and larger staffs are important and necessary components of the Mission 66 program, there are other parts of it, together with the buildings, and improved roads—measureable items in themselves—which make this program a practical, forward-looking conservation effort.

In the final analysis, the true measure of Mission 66, is the improved benefits accruing to the millions of citizens who visit and treasure our park system. As an example of the former, park visitors will find the natural scene and the historic features of the park system more meaningful than ever before through new visitor centers, roadside exhibits and markers, and self-guiding interpretive devices.

Of equal importance are the improved information, guide, and talk programs offered on a larger scale than ever before by a trained and adequate staff.

As a result of those improvements, interpretive services to visitors are being more widely used. Millions of visitors are flocking to museums, participating in conducted trips, using self-guiding devices, attending campfire sessions or amphitheater gatherings where park naturalists and park historians interpret the rich resources of the parks. In all of these ways, visitors are gaining a clearer and deeper understanding of what they see in the parks and of the natural and human history of their country.

Many-Phased Program

Other phases of Mission 66 are contributing to increase the visitor use and enjoyment. For example, special attention is being given to the acquisition of privately owned lands within park boundaries. When Mission 66 started, there were nearly 700,000 acres of such lands, obstructing adequate development and interfering with visitor use and enjoyment. In the first 2 years of the program, almost 78,000 acres of those inholdings have been acquired by purchase, donation, or exchange.

Other work is also moving forward: on a long-range national park system plan to help chart the way for selecting outstanding scenic, scientific, and historic areas to fulfill the Nation's future park needs; on historic American buildings and historic site surveys; on recreation resource planning—in cooperation with other Federal agencies, States, and local governments—to meet the people's recreational needs at all levels of Government; on the Pacific Coast seashore and Great Lakes surveys to locate and report on available areas of significance for possible preservation and public use.

Mission 66 represents a new era in the sound use of national parks and monuments. Achievement of its goal will give America a park system adequately expanded, preserved, developed, and staffed to meet the requirements of the future.

In years to come, with population growth continuing, increasing numbers of Americans will seek healthful recreation and inspiration in the great outdoors. The Department looks ahead to those years confident that the treasured areas of scenic beauty and historic interest, which are the people's heritage, will continue to be appreciated, appropriately used, and handed down "unimpaired for the enjoyment of future generations."

PART II


ANNUAL REPORTS OF THE
BUREAUS AND OFFICES OF THE
DEPARTMENT OF THE INTERIOR



Office of the Assistant Secretary

Water and Power Development

Fred G. Aandahl, *Assistant Secretary*



THE ASSISTANT SECRETARY for Water and Power Development discharges the duties of the Secretary with respect to the Department's programs in the field of water and power development. The Assistant Secretary exercises secretarial direction and supervision over the Bureau of Reclamation, Bonneville Power Administration, Southeastern Power Administration, and Southwestern Power Administration. The principal function of the latter three agencies is to market surplus power generated in their respective areas at Federal projects. The Bureau of Reclamation constructs water-use projects whose primary purpose is the reclamation of arid and semiarid lands in the West, and also markets surplus power produced at Federal projects in the West outside the boundaries of the Bonneville Power Administration and Southwestern Power Administration and the Falcon Dam on the Rio Grande River, an international project. The Assistant Secretary for Water and Power Development is also responsible for carrying out the defense functions of the Secretary with respect to electric power and for supervising and directing the Office of Saline Water. The activities of the water and power agencies of the Department and the Office of Saline Water are more fully described in sections of this report covering each of the Department's bureaus and offices.

The table on the next page, prepared on a consolidated basis for fiscal year 1958, shows the installed capacity of plants whose power is marketed by Department of the Interior agencies, net energy generation, energy marketed, and gross revenues.

The Assistant Secretary for Water and Power Development participated in the negotiation of contracts for the marketing of power and integration of power systems in the operating areas of the Southwestern Power Administration and the Southeastern Power Adminis-

Power production and marketing data, fiscal year ended June 30, 1958

| Marketing agency | Installed capacity, as of June 30, 1958 (kilowatts) | Net energy generated (million kilowatt-hours) | Energy marketed (million kilowatt-hours) | Gross revenue (thousands of dollars) |
|--|---|---|--|--------------------------------------|
| Bureau of Reclamation..... | ¹ 5,870,000 | 30,366 | ⁴ 16,663 | ⁵ 54. |
| Bonneville Power Administration..... | ² 3,063,000 | 17,630 | 28,365 | 65. |
| Southeastern Power Administration..... | ² 1,247,000 | 4,025 | ⁶ 4,009 | 19. |
| Southwestern Power Administration..... | ² 501,000 | 2,016 | ⁶ 2,177 | 13. |
| Total | 9,681,000 | 54,037 | 51,214 | 152. |

¹ Includes 745,000 kilowatts in Corps of Engineers, 31,500 kilowatts in International Boundary and Water Commission, and 5,093,500 kilowatts in Bureau of Reclamation projects.

² Capacity in Corps of Engineers projects.

³ Bonneville Power Administration also markets power from Bureau of Reclamation Grand Coulee, Hungry Horse, and Chandler powerplants with a capacity of 2,271,000 kilowatts. (This amount in Bureau of Reclamation installed capacity.)

⁴ Excludes 12,571 million kilowatt-hours delivered at Grand Coulee, Hungry Horse, and Chandler powerplants by Bureau of Reclamation to Bonneville Power Administration. (This amount included in Bonneville Power Administration energy marketed.)

⁵ Excludes \$16,587,000 revenue received by Bureau of Reclamation from Bonneville Power Administration. (This amount included in Bonneville Power Administration revenue.)

⁶ Includes purchased energy.

tration. In the Southwest major changes in generating and transmission contracts were completed to comply with the directive of Congress that power should be delivered, insofar as practicable, at a uniform rate in the Southwest.

In the Southeast the sale of power to preference customers is impeded by wheeling and firming contracts. Such a contract of May 16, 1956, with a private utility for the sale, firming and delivery of one-half of the Clark Hill project output in Georgia was renegotiated to include Buford and Allatoona projects under the same basic arrangement. The new contract expanded the marketing area to include the southern part of Georgia which has recently been added to the system of the private utility that performs the firming and wheeling services through an acquisition of power facilities of another company by this utility. On July 19, 1957, a contract was signed with a private utility for the sale, wheeling and firming of Jim Woodruff project power in northern Florida within a radius of 150 miles of the project. Several preference customers are being served in this area. On June 28, 1957, a transmission service contract was signed with the same private utility that performs firming and wheeling services under the Clark Hill-Allatoona-Buford contract and the integration of these projects with the Jim Woodruff project.

On August 9, 1957, the Federal Power Commission approved and confirmed new rate schedules for the sale of power by the Southwestern Power Administration. The Assistant Secretary for Water and Power Development participated in discussions with the Southwestern Power Administration about plans for marketing new power that will be available from federally constructed multiple-purpose projects during the next several years. This planning included a

extensive network analyzer study participated in by most of the public and private utilities in the southwestern marketing area.

Progress has continued on an important power cooperative program in the Northwest where Bonneville Power Administration has now entered into 10-long-term contracts with non-Federal utilities that are constructing hydroelectric projects to have the power output transmitted to load centers over the Federal transmission grid in the Northwest. This program has made the construction of non-Federal hydroelectric generating capacity more feasible. It will result in more complete regional integration and the most economic development of hydroelectric resources. The Federal Government will be fully reimbursed for the use of its transmission facilities.

During the fiscal year, the Department through the Assistant Secretary for Water and Power Development reviewed 26 reports of the Corps of Engineers, Department of the Army, primarily for flood control and navigation improvements; 39 Federal Power Commission applications for permits and licenses for hydroelectric developments; and 1 report of the Public Health Service, Department of Health, Education, and Welfare, for water pollution control.

The Assistant Secretary for Water and Power Development served as departmental representative on the Inter-Agency Committee on Water Resources and on the President's Advisory Committee on Public Works Planning. He participated in inter-agency conferences on the coordination of watershed, flood-control, and reclamation programs. The Assistant Secretary conducted conferences in the field and in Washington on power marketing and irrigation development, attended by water and power users, congressional delegations, and representatives of local interests and industry. He represented the Department also in a field conference on the agricultural and wildlife uses of lands in the lower Klamath-Tule Lake region in California and Oregon. The Assistant Secretary conferred with the group of non-Federal advisers to the Secretary on progress and problems in saline water conversion.

The Assistant Secretary presented testimony before congressional committees on the Fryingpan-Arkansas and San Luis (California) reclamation projects and other reclamation matters; on the progress of research and development in saline water conversion; on authorization of construction of plants for the conversion of saline water; and on the establishment of Boulder City as a municipality under the laws of the State of Nevada.

Staff of the Office served as departmental representatives on inter-agency committees concerned with radio frequency allocation, procurement of heavy electrical equipment, international water developments, public works planning, coordination of water resources projects.

ects, cost allocation, financial practices for water and power projects, economic analyses, user charges on inland waterways, atomic energy, and allied technical subjects.

Other activities of the Assistant Secretary and his staff include continued studies of the joint Army-Interior policy on land acquisition for reservoirs and analysis of potential reservoir storage at Arrow Lakes and other sites in Canada to increase power production in the Columbia Basin.

BUREAU OF RECLAMATION

Wilbur A. Dexheimer, *Commissioner*



THE BUREAU OF RECLAMATION made significant progress in development of projects for sound use of our water resources in the fiscal year ending June 30, 1958. Some of these accomplishments were:

An investment of about \$180 million in construction of irrigation, power, and related water and land utilization facilities, including concrete and earth dams, power and pumping plants, irrigation canals and their extensive lateral and sublateral systems, aqueducts and other works.

Completion of six storage dams, which added more than 4 million acre-feet of capacity in new Reclamation project reservoirs and 726 miles of canals, pipelines, laterals, sublaterals, and drains. A total of 61,950 kilowatts of hydroelectric generating capacity was added to the Nation's power system as a part of multipurpose dam construction.

A total of 168,797 acres was added to the irrigation service area of Federal reclamation projects in 1957 (latest recorded year), bringing the total area subject to irrigation service to 7,827,598 acres. The new acreage was principally in the Missouri River Basin including the following units: Hanover Bluff and Owl Creek in Wyoming, Sargent in Nebraska, and Kirwin in Kansas.

Irrigated land provided with irrigation service from Bureau of Reclamation facilities now totals 3,319,425 acres; supplemental water service extends to 3,188,597 irrigated acres, and 49,244 acres are furnished with temporary water service. The area irrigated in the 1957 crop year was 6,557,266 acres, an increase of 157,123 acres over 1956.

The value of crop production on 77 Reclamation projects amounted to \$928,156,918, and averaged \$141.55 per acre. The cumulative value of crops grown on Federal Reclamation projects since 1906 is \$13,277,660,991.

Hydroelectric plants at multipurpose Reclamation projects on the lower Colorado River supplied nearly 21 percent of the total kilo-

watt-hours of energy consumed in the Pacific Southwest. Net generation at the Reclamation plants in this area of 7,224,840,026 kilowatt-hours exceeded that of 1957 and 1956 by 79 and 77 percent, respectively. This resulted from a good water supply on the river.

Fiscal year 1958 was highlighted by the award of contracts for construction of the Flaming Gorge Dam and powerplant in Utah and Navajo Dam in New Mexico. These structures, together with Glen Canyon Dam placed under construction in Arizona in 1957, are the principal elements in the 4-State Colorado River Storage project which will lead to the development of the land, water, and other resources of the Upper Colorado River Basin. Navajo Dam on San Juan River in New Mexico will be the Bureau of Reclamation's second largest earthfill dam, exceeded in size only by the Trinity Dam under construction in the Central Valley project in California.

The total value of all contracts awarded during the fiscal year amounted to about \$135 million, comprising the face value of 561 separate contracts for construction, materials, and equipment. Construction contracts totaled about \$115 million or about 85 percent of this total contract aggregate. The 158 construction contracts in force at the end of the fiscal year had a total face value of about \$100 million.

Reclamation reservoirs, dams, and powerplants continued to be leading tourist attractions with more than 10,000,000 persons making visits to them. During calendar year 1957, 460,994 persons took the Bureau's guided tour of Hoover Dam and powerplant to establish a new all-time record for this installation. The previous high was set in 1956 when 452,018 persons were conducted through the dam and powerplant by Bureau guides. An estimated 18,000 persons took self-guided tours at Davis and Parker Dams during 1958, which was the first year this service was offered to the public.

A record number, 1,179,100 people visited the three large developed reservoirs at Shasta, Friant, and Folsom Dams on the Central Valley project in California in 1957, with record crowds also visiting other reservoirs in the State during the year.

In the Missouri River Basin, Region 6 of the Bureau of Reclamation with headquarters in Billings, Mont., made 222,680 acres of reservoir areas available to the public for the first time for general recreation. The areas, made up of 23 reservoirs or sump sites, provided 1,670 lakes with a total of 670 miles of shoreline. The grand total of land and water made available to the public for general recreation use exceeds, probably by at least 20 times, the acreage purchased or otherwise made available to the public for the same uses during the period 1946-58. It is estimated that 1,265,000 people will have visited 23 reservoir areas in 1958.

The Bureau's administrative structure in Washington was changed in 1958 by the establishment of the position of Associate Commissioner and abolishment of one of two Assistant Commissionerships.

The 103 Reclamation projects, located throughout the 17 Western States, are divided into 7 regions for administrative purposes. The Bureau also maintains a District Office at Juneau, Alaska.

States located mainly within each region, and regional headquarters, are as follows:

Region 1—Washington, Oregon, Idaho, and western Montana. Boise, Idaho.

Region 2—California, except southern portion. Sacramento, Calif.

Region 3—Arizona, southern California, and southern Nevada. Boulder City, Nev.

Region 4—Nevada, Utah, western Colorado and southwestern Wyoming. Salt Lake City, Utah.

Region 5—Texas, New Mexico, Oklahoma, and southern Kansas. Amarillo, Tex.

Region 6—Eastern Montana, North Dakota, South Dakota, and northern Wyoming. Billings, Mont.

Region 7—Eastern Colorado, Nebraska, southern Kansas and southwestern Wyoming. Denver, Colo.

DIVISION OF IRRIGATION

Crop Production

The Bureau of Reclamation in calendar year 1957 provided full irrigation service for 3,319,425 acres of irrigated land. Supplemental water service was provided to 3,188,597 irrigated acres, and temporary water service was furnished for 49,244 irrigated acres. The total area irrigated in 1957 was 6,557,266 acres, an increase of 157,123 acres over 1956.

There were 126,890 irrigated farms on Federal Reclamation projects of which 80 percent were full-time operating units. These full-time units provided support for 392,239 farm people. In addition there were 94,136 people on part-time farms served by the Bureau.

Four new units of the Missouri River Basin project and 168,797 acres were added to the irrigation service area of Federal Reclamation projects in 1957, bringing the total area subject to irrigation service to 6,726,063 acres. The new units were Hanover Bluff and Owl Creek in Wyoming, Sargent in Nebraska, and Kirwin in Kansas.

[illegible]

TABLE 1.—*Irrigation and gross crop value data by type of irrigation service for each State, 1957—Continued*

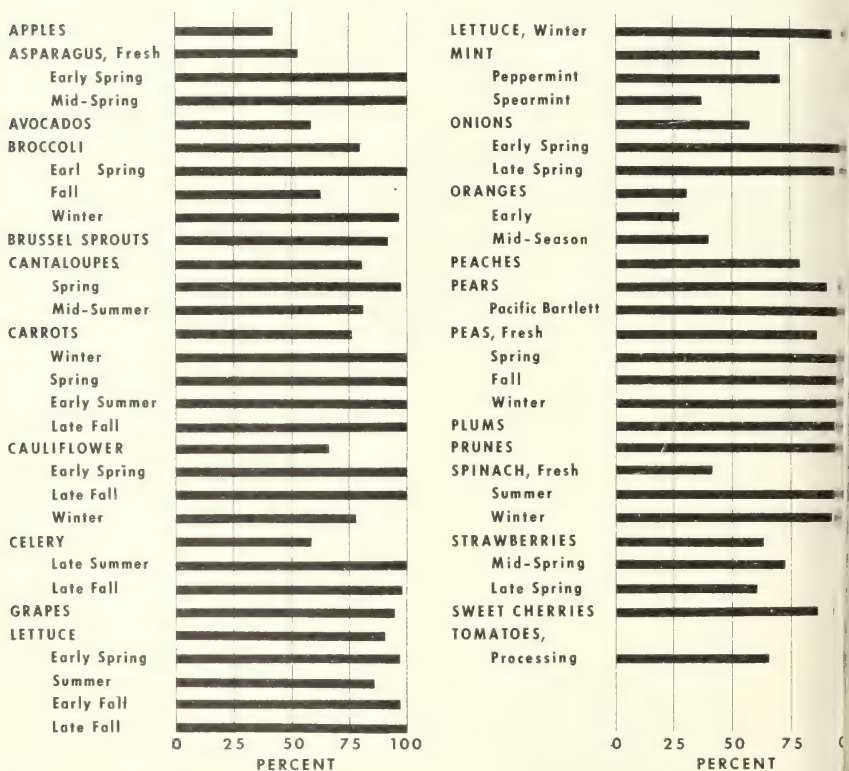
| State | Project and division | Full irrigation service | | | Supplemental irrigation service | | | Temporary irrigation service | | | Total | | |
|--------------|--|-------------------------|------------|----------------|---------------------------------|------------|----------------|------------------------------|---------|----------------|------------------|---------|----------------------------|
| | | Gross crop value | | Irrigated area | Gross crop value | | Irrigated area | Gross crop value | | Irrigated area | Gross crop value | | Average per acre irrigated |
| | | Acres | Dollars | | Acres | Dollars | | Acres | Dollars | | Acres | Dollars | Dollars |
| North Dakota | Buford-Trenton | 8,131 | 534,476 | 0 | 0 | 0 | 0 | 0 | 0 | 8,131 | 534,476 | 65.73 | |
| | Lower Yellowstone (see also Montana) | 17,069 | 1,135,526 | 0 | 0 | 0 | 0 | 0 | 0 | 17,069 | 1,135,526 | 66.53 | |
| | Missouri River Basin: Heart Division: | | | | | | | | | | | | |
| | Dickinson Unit | 350 | 16,025 | 0 | 0 | 0 | 0 | 0 | 0 | 350 | 16,025 | 45.79 | |
| | Heart Butte Unit | 350 | 14,149 | 0 | 0 | 0 | 0 | 0 | 0 | 350 | 14,149 | 40.43 | |
| Oklahoma | North Dakota Pumping Division: Fort Clark Unit | 589 | 32,678 | 0 | 0 | 0 | 0 | 0 | 0 | 589 | 32,678 | 55.48 | |
| | Subtotals | 26,489 | 1,732,854 | 0 | 0 | 0 | 0 | 0 | 0 | 26,489 | 1,732,854 | 65.42 | |
| | W. C. Austin | 39,890 | 3,126,330 | 0 | 0 | 0 | 0 | 0 | 0 | 39,890 | 3,126,330 | 78.37 | |
| | Subtotals | 39,890 | 3,126,330 | 0 | 0 | 0 | 0 | 0 | 0 | 39,890 | 3,126,330 | 78.37 | |
| Oregon | Arnold | 2,599 | 84,971 | 0 | 0 | 0 | 0 | 0 | 0 | 2,599 | 84,971 | 32.69 | |
| | Baker | 0 | 0 | 7,266 | 0 | 311,612 | 0 | 0 | 0 | 7,266 | 311,612 | 42.89 | |
| | Boise (see also Idaho) | 1,492 | 89,769 | 0 | 0 | 0 | 0 | 0 | 0 | 1,492 | 89,769 | 60.17 | |
| | Burnt River | 0 | 0 | 15,489 | 0 | 726,868 | 0 | 0 | 0 | 15,489 | 726,868 | 46.93 | |
| | Crescent Lake Dam | 6,345 | 298,547 | 0 | 0 | 0 | 0 | 0 | 0 | 6,345 | 298,547 | 47.05 | |
| | Deschutes | 46,520 | 5,349,191 | 45,190 | 0 | 2,283,416 | 0 | 0 | 0 | 91,710 | 7,632,607 | 83.23 | |
| | Grants Pass | 7,455 | 943,033 | 0 | 0 | 0 | 0 | 0 | 0 | 7,455 | 943,033 | 126.50 | |
| | Klamath (see also California) | 115,876 | 9,811,641 | 0 | 0 | 0 | 0 | 0 | 0 | 115,876 | 9,811,641 | 84.67 | |
| | Ochoco | 8,222 | 727,329 | 0 | 0 | 0 | 0 | 0 | 0 | 8,222 | 727,329 | 88.46 | |
| | Owyhee (see also Idaho) | 66,976 | 8,283,966 | 12,860 | 0 | 2,815,389 | 0 | 0 | 0 | 79,836 | 11,099,355 | 139.03 | |
| | Rogue River Basin | 8,925 | 2,043,532 | 12,637 | 0 | 3,614,615 | 0 | 0 | 0 | 21,562 | 5,658,147 | 262.41 | |
| | Umatilla | 11,855 | 664,126 | 10,847 | 0 | 1,061,661 | 0 | 494 | 69,397 | 23,196 | 1,795,184 | 77.39 | |
| | Vale | 31,285 | 2,112,932 | 0 | 0 | 0 | 0 | 0 | 0 | 31,285 | 2,112,932 | 67.54 | |
| | Subtotals | 307,550 | 30,409,057 | 104,289 | 0 | 10,813,561 | 0 | 494 | 69,397 | 412,333 | 41,292,015 | 100.14 | |

| | | | | | | | | | | |
|---|-----------------------------------|---------------|-------------|---------------|---------|-------------|---|-------------|---------------|---------|
| Texas | Cheyenne Division: Angostura Unit | | | | | | | | | |
| | Rapid Valley | | | | | | | | | |
| | 10, 931 | 567, 021 | 0 | 0 | 0 | 0 | 0 | 10, 931 | 567, 021 | 51, 87 |
| Utah | Subtotals | | | | | | | | | |
| | 65, 727 | 2, 816, 310 | 6, 729 | 150, 686 | 0 | 0 | 0 | 72, 456 | 2, 966, 996 | 40, 95 |
| | 50, 705 | 13, 317, 240 | 4, 378 | 1, 449, 764 | 0 | 0 | 0 | 55, 083 | 14, 767, 004 | 227, 09 |
| Washington | Subtotals | | | | | | | | | |
| | 50, 705 | 13, 317, 240 | 9, 745 | 2, 668, 578 | 0 | 0 | 0 | 60, 450 | 15, 985, 818 | 264, 45 |
| | 15, 760 | 820, 727 | 21, 350 | 1, 677, 575 | 3, 541 | 234, 109 | 0 | 90, 974 | 9, 298, 258 | 75, 91 |
| Wyoming | Subtotals | | | | | | | | | |
| | 15, 760 | 820, 727 | 256, 492 | 19, 879, 383 | 3, 541 | 234, 109 | 0 | 275, 793 | 20, 934, 219 | 120, 89 |
| | 203, 097 | 24, 552, 156 | 0 | 0 | 0 | 0 | 0 | 203, 097 | 24, 552, 156 | 159, 22 |
| Missouri River Basin: Bighorn Basin Division: | Kendrick | | | | | | | | | |
| | 3, 987 | 634, 792 | 0 | 0 | 0 | 0 | 0 | 3, 987 | 634, 792 | 175, 17 |
| | 228, 124 | 37, 916, 021 | 164, 592 | 30, 872, 576 | 161 | 31, 445 | 0 | 392, 877 | 68, 820, 042 | 156, 69 |
| North Platte (see also Nebraska) | Subtotals | | | | | | | | | |
| | 435, 208 | 63, 102, 969 | 164, 592 | 30, 872, 576 | 161 | 31, 445 | 0 | 599, 961 | 94, 006, 990 | 31, 30 |
| | 10, 495 | 328, 483 | 0 | 0 | 0 | 0 | 0 | 10, 495 | 328, 483 | 35, 05 |
| Shoshone | Subtotals | | | | | | | | | |
| | 14, 927 | 523, 264 | 0 | 0 | 0 | 0 | 0 | 14, 927 | 523, 264 | 75, 25 |
| | 49, 889 | 3, 581, 566 | 10, 040 | 440, 360 | 0 | 147, 341 | 0 | 1, 958 | 147, 341 | 48, 79 |
| Totals, all States | Subtotals | | | | | | | | | |
| | 50, 061 | 2, 111, 672 | 14, 980 | 880, 744 | 0 | 0 | 0 | 64, 869 | 4, 462, 310 | 42, 18 |
| | 75, 913 | 4, 799, 122 | 0 | 0 | 0 | 0 | 0 | 50, 061 | 2, 111, 672 | 63, 22 |
| Totals, all States | Subtotals | | | | | | | | | |
| | 201, 285 | 11, 344, 107 | 25, 020 | 1, 321, 104 | 1, 958 | 147, 341 | 0 | 228, 293 | 12, 812, 552 | 56, 13 |
| | 3, 319, 425 | 475, 361, 045 | 3, 188, 597 | 444, 337, 542 | 49, 244 | 8, 458, 331 | 0 | 6, 537, 266 | 928, 156, 918 | 141, 55 |

Other major additions to irrigated acreage occurred on the following projects: Boulder Canyon, Colorado-Big Thompson, Columbia Basin Gila, Minidoka, and Rogue River Basin. The upward revision of the Colorado-Big Thompson project acreage is based on results of a complete survey of irrigated land under the project. States gaining 5,000 or more acres of irrigated area in Reclamation projects were California, Colorado, Idaho, Nebraska, Washington, and Wyoming.

PROPORTIONS OF MAJOR FRUIT AND VEGETABLE CROPS GROWN IN THE 17 RECLAMATION STATES

SHOWING PRINCIPAL SEASONAL PRODUCTION



THE RECLAMATION STATES PRODUCE **ALL** COMMERCIAL

| | | | |
|------------|-----------------|-----------------|--------|
| ALMONDS | DATES | FILBERTS | HOPS |
| APRICOTS | ENGLISH WALNUTS | GARLIC | LEMONS |
| ARTICHOKES | FIGS | HONEYDEW MELONS | OLIVES |
| RAISINS | | | |

More than 150 important crops were grown on Reclamation projects. Specialty crops occupied only 16 percent of the acreage but produced 16 percent of the total crop value. For example, the grape harvest totaled \$42.3 million, lettuce \$30 million, and fresh market tomatoes \$11.1 million. Melons added \$18.7 million, carrots \$10.4 million, and beans \$15.9 million. Seeds, mint, and nuts accounted for \$29.1, \$3.6, and \$5.5 million, respectively. Other specialty crops accounted for \$11.1 million.

Irrigated lands on Reclamation projects did not contribute significantly to national crop surpluses. Tobacco, corn, wheat, and cotton account for about 86 percent of the value of all commodities under production and in inventory of the Commodity Credit Corporation. None of the tobacco, less than one-third of 1 percent of the corn, 1.8 percent of wheat, and 2.4 percent of the cotton involved in the surplus program was grown on Reclamation projects.

Grain and Forage Crops

Almost three-fourths of the irrigated acreage in Reclamation projects is devoted to the production of grain and forage, chiefly livestock feed crops. The livestock enterprises of these farms are of great significance to the rapidly growing population of the Western States which heavily rely on this prime beef and lamb production. The center of the meatpacking industry has been moving constantly westward. The hypothetical breaking point between eastbound and westbound livestock shipments is now near the eastern base of the Rocky Mountains.

The intensified demand from Pacific coastal population centers will move this breaking point further east as time goes on, adding emphasis to the need for finished meat production in the West. The grain and forage production on the irrigated lands of the West complements the grazing value of 700,000 acres of rangeland, making it more valuable to the cause of providing meat for the Nation's dinner tables. The acreage and production of these crops were slightly greater than in 1956. Their value amounted to \$267,922,757 in 1957, approximately 29 percent of the value of all crop production.

Miscellaneous Field Crops

Miscellaneous field crops rank third in acreage but first in value among the several classes of crops. These crops include dry beans, cotton, sugar beets and other cash crops which are usually the pivot-point of a farmer's cropping rotation.

Sugar beets are probably the most generally grown cash crop on western irrigation projects. Reclamation projects supply a little

TABLE 2.—Acreage, production, and gross crop value by crops and types of crops, 1957

| Crops | Irrigated lands | | Tonnage | | Gross crop value | |
|---------------------------------------|-----------------|------------------|-------------|------------------|------------------|------------------|
| | Total | Percent of total | Total | Percent of total | Total | Percent of total |
| Cereals: | <i>Acres</i> | <i>Percent</i> | <i>Tons</i> | <i>Percent</i> | <i>Dollars</i> | <i>Percent</i> |
| Barley..... | 570,241 | 8.70 | 724,830 | 2.45 | 29,895,077 | |
| Corn..... | 277,211 | 4.23 | 509,674 | 1.72 | 21,764,090 | |
| Oats..... | 197,088 | 3.01 | 172,145 | .58 | 7,007,037 | |
| Rice..... | 4,807 | .07 | 9,503 | .03 | 838,503 | |
| Rye..... | 4,863 | .07 | 4,129 | .01 | 144,487 | |
| Sorghums (sorgo, kaffir, etc.)..... | 124,696 | 1.90 | 161,226 | .54 | 8,074,157 | |
| Wheat..... | 451,747 | 6.89 | 667,593 | 2.26 | 40,086,644 | |
| Other cereals..... | 79,490 | 1.21 | 120,202 | .41 | 4,594,822 | |
| Subtotals..... | 1,710,143 | 26.08 | 2,369,302 | 8.00 | 112,404,817 | |
| Forage: | | | | | | |
| Alfalfa, hay..... | 1,598,679 | 24.38 | 6,198,061 | 20.93 | 103,421,271 | |
| Other hay..... | 205,201 | 3.13 | 412,867 | 1.39 | 5,912,525 | |
| Irrigated pasture..... | 936,914 | 14.29 | 2,473,836 | 8.36 | 28,486,798 | |
| Corn fodder..... | 14,646 | .22 | 140,725 | .48 | 816,291 | |
| Silage or ensilage..... | 174,009 | 2.65 | 2,099,409 | 7.09 | 12,649,007 | |
| Crop residue: | | | | | | |
| Beet tops..... | | | 1,719,091 | 5.81 | 1,029,990 | |
| Stubble, stalks, etc..... | | | 147,163 | .50 | 1,138,492 | |
| Straw (all kinds)..... | | | 226,791 | .77 | 1,071,986 | |
| Root crops (carrots, etc.)..... | 422 | .01 | 8,335 | .03 | 17,453 | |
| Other forage..... | 57,392 | .88 | 90,239 | .30 | 974,127 | |
| Subtotals..... | 2,987,263 | 45.56 | 13,516,517 | 45.66 | 155,517,940 | |
| Miscellaneous field crops: | | | | | | |
| Beans, castor..... | 4,316 | .07 | 3,861 | .01 | 571,328 | |
| Beans, dry and edible..... | 325,467 | 4.96 | 264,226 | .89 | 30,830,455 | |
| Broomcorn..... | 7,067 | .11 | 1,332 | .01 | 325,680 | |
| Cotton, lint (Upland)..... | 395,094 | 6.02 | 189,066 | .64 | 130,292,677 | |
| Cotton, seed (Upland)..... | | | 305,273 | 1.03 | 16,595,640 | |
| Cotton, lint (American-Egyptian)..... | 42,427 | .65 | 9,074 | .03 | 10,496,607 | |
| Cotton, seed (American-Egyptian)..... | | | 18,170 | .06 | 1,149,411 | |
| Hops..... | 16,099 | .25 | 15,693 | .05 | 15,946,940 | |
| Peppermint..... | 11,924 | .18 | 455 | | 2,966,392 | |
| Spearmint..... | 2,704 | .04 | 120 | | 667,306 | |
| Sugar beets..... | 344,453 | 5.25 | 6,467,092 | 21.84 | 68,847,430 | |
| Other miscellaneous field crops..... | 2,123 | .03 | 9,040 | .03 | 211,200 | |
| Subtotals..... | 1,151,674 | 17.56 | 7,283,402 | 24.59 | 278,901,066 | |
| Vegetables: | | | | | | |
| Asparagus..... | 13,065 | .20 | 19,476 | .07 | 3,971,622 | |
| Beans (processing)..... | 6,268 | .10 | 11,852 | .04 | 1,706,739 | |
| Beans (fresh market)..... | 1,101 | .02 | 3,274 | .01 | 1,077,766 | |
| Broccoli..... | 1,174 | .02 | 4,161 | .01 | 616,560 | |
| Cabbage..... | 2,324 | .04 | 26,192 | .09 | 1,168,884 | |
| Carrots..... | 12,528 | .19 | 139,866 | .47 | 10,400,255 | |
| Cauliflower..... | 40 | | 80 | | 9,719 | |
| Celery..... | 592 | .01 | 13,312 | .04 | 745,118 | |
| Corn, sweet (processing)..... | 18,924 | .29 | 110,671 | .37 | 2,716,557 | |
| Corn, sweet (fresh market)..... | 7,740 | .12 | 23,858 | .08 | 2,721,000 | |
| Cucumbers..... | 2,073 | .03 | 14,248 | .05 | 984,797 | |
| Greens (kale, etc.)..... | 175 | | 1,225 | | 98,000 | |
| Lettuce..... | 61,509 | .94 | 364,652 | 1.23 | 30,021,065 | |
| Melons: | | | | | | |
| Cantaloupes, etc..... | 24,998 | .38 | 130,224 | .44 | 12,600,120 | |
| Honey ball, honeydew, etc..... | 4,112 | .06 | 49,463 | .17 | 3,111,655 | |
| Watermelons..... | 8,696 | .13 | 65,620 | .22 | 2,963,304 | |
| Onions, dry..... | 11,905 | .18 | 187,639 | .63 | 7,794,135 | |
| Onions, green..... | 253 | | 1,139 | | 114,420 | |
| Peas, green (processing)..... | 14,853 | .23 | 23,753 | .08 | 1,967,477 | |
| Peas, green (fresh market)..... | 818 | .01 | 1,743 | .01 | 355,164 | |
| Peppers (all kinds)..... | 2,437 | .04 | 15,300 | .05 | 1,828,903 | |
| Potatoes, early..... | 38,346 | .58 | 517,014 | 1.75 | 12,818,244 | |
| Potatoes, late..... | 203,472 | 3.10 | 2,142,046 | 7.24 | 47,382,863 | |
| Squash..... | 2,544 | .04 | 8,850 | .03 | 1,102,073 | |
| Sweet potatoes..... | 642 | .01 | 2,063 | .01 | 230,248 | |
| Tomatoes (canning)..... | 17,532 | .27 | 227,126 | .77 | 5,256,569 | |

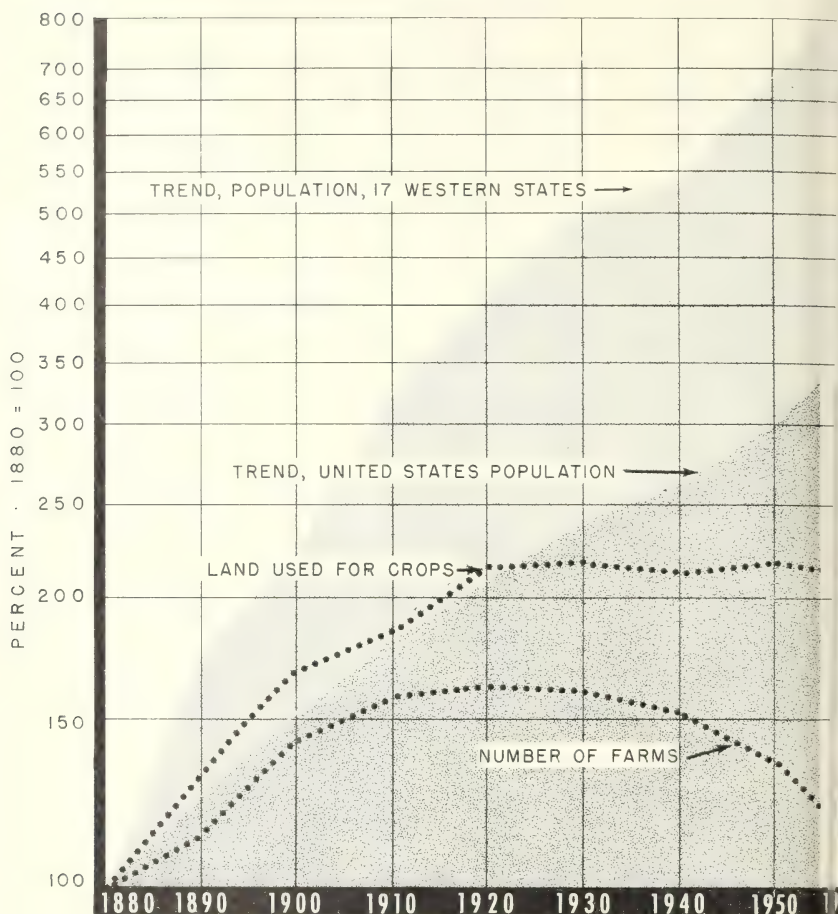
See footnotes at end of table.

TABLE 2.—Acreage, production, and gross crop value by crops and types of crops, 1957—Continued

| Crops | Irrigated lands | | Tonnage | | Gross crop value | |
|--|-----------------|------------------|-------------|------------------|------------------|-------------------------------|
| | Total | Percent of total | Total | Percent of total | Total | Percent of total ¹ |
| | <i>Acres</i> | <i>Percent</i> | <i>Tons</i> | <i>Percent</i> | <i>Dollars</i> | <i>Percent</i> |
| ables—Continued | | | | | | |
| Tomatoes (fresh market)..... | 11,345 | 0.17 | 77,517 | 0.26 | 15,062,587 | 1.62 |
| Other vegetables..... | 4,622 | .07 | 31,250 | .11 | 2,177,539 | .23 |
| Subtotals..... | 474,088 | 7.23 | 4,213,614 | 14.23 | 171,003,383 | 18.42 |
| Total nursery..... | 3,200 | .05 | | | 8,130,409 | .88 |
| Alfalfa..... | 111,565 | 1.70 | 23,064 | .08 | 11,718,877 | 1.26 |
| Over (all kinds)..... | 41,502 | .63 | 7,367 | .02 | 3,497,958 | .38 |
| Ornamentals..... | 5,971 | .09 | 8,381 | .03 | 1,153,076 | .12 |
| Pea seed..... | 30,838 | .47 | 31,089 | .11 | 3,518,902 | .38 |
| Peas (all kinds)..... | 13,258 | .20 | 4,272 | .01 | 1,545,999 | .17 |
| Potatoes..... | 1,668 | .03 | 227 | | 362,620 | .04 |
| Pumpkins..... | 914 | .01 | 198 | | 331,675 | .04 |
| Spinach..... | 43,400 | .66 | 45,577 | .15 | 4,208,129 | .45 |
| Tomato (all kinds)..... | 1,924 | .03 | 19,608 | .07 | 803,143 | .09 |
| Winter beet..... | 1,745 | .03 | 2,531 | .01 | 732,782 | .08 |
| Winter seed..... | 11,192 | .17 | 8,565 | .03 | 1,241,559 | .13 |
| Subtotals..... | 263,977 | 4.02 | 150,879 | .51 | 29,114,720 | 3.14 |
| Apples..... | 41,924 | .64 | 430,523 | 1.45 | 16,896,956 | 1.82 |
| Peaches..... | 6,532 | .10 | 39,967 | .14 | 3,189,470 | .34 |
| Pears (all kinds)..... | 1,650 | .03 | 2,951 | .01 | 1,034,934 | .11 |
| Cherries..... | 7,678 | .12 | 18,404 | .06 | 5,003,059 | .54 |
| Plums: | | | | | | |
| Grapefruit..... | 16,532 | .25 | 183,158 | .62 | 7,351,477 | .79 |
| Lemons and limes..... | 10,606 | .16 | 90,818 | .31 | 5,260,364 | .57 |
| Oranges and tangerines..... | 30,042 | .46 | 297,825 | 1.01 | 23,481,954 | 2.53 |
| Strawberries..... | 4,074 | .06 | 9,553 | .03 | 3,437,171 | .37 |
| Apples, table..... | 56,728 | .87 | 360,871 | 1.22 | 31,468,828 | 3.39 |
| Apples, other..... | 29,785 | .45 | 213,411 | .72 | 10,832,212 | 1.17 |
| Plums..... | 8,036 | .12 | 12,454 | .04 | 2,887,204 | .31 |
| Peaches..... | 23,964 | .37 | 145,746 | .49 | 10,288,910 | 1.11 |
| Pears..... | 25,223 | .38 | 197,618 | .67 | 10,503,053 | 1.13 |
| Plums and plums..... | 9,389 | .14 | 53,486 | .18 | 4,994,713 | .54 |
| Other fruits..... | 3,340 | .05 | 5,625 | .02 | 874,597 | .09 |
| Subtotals..... | 275,503 | 4.20 | 2,062,410 | 6.97 | 137,504,902 | 14.81 |
| Almonds..... | 6,044 | .09 | 2,528 | .01 | 1,295,218 | .14 |
| Chestnuts..... | 5,000 | .08 | 3,046 | .01 | 2,024,438 | .22 |
| Walnuts..... | 6,298 | .10 | 4,490 | .02 | 2,181,530 | .23 |
| Other nuts..... | 92 | | 71 | | 35,057 | |
| Subtotals..... | 17,434 | .27 | 10,135 | .04 | 5,536,243 | .59 |
| Vegetable gardens and orchards..... | 20,896 | .32 | | | 4,048,667 | .44 |
| Total, all crops..... | 6,904,178 | 105.29 | 29,606,259 | 100.00 | 902,162,147 | 97.20 |
| Multiple cropped..... | 486,754 | 7.42 | | | | |
| Total, harvested cropland and pasture..... | 6,417,424 | 97.87 | | | | |
| Land not harvested..... | 118,997 | 1.81 | | | | |
| Barren land..... | 20,845 | .32 | | | | |
| Cropland irrigated..... | 6,557,266 | 100.00 | | | | |
| Net revenues ² | | | | | 25,994,771 | 2.80 |
| Total, gross crop value..... | | | | | 928,156,918 | 100.00 |
| Irrigation service..... | 3,319,425 | | | | 475,361,045 | |
| Reclamation service..... | 3,188,597 | | | | 444,337,542 | |
| Other irrigation service..... | 49,244 | | | | 8,458,331 | |

¹ Additional revenues are included in computing percentages.
² Includes payments received from Federal and commercial agencies.

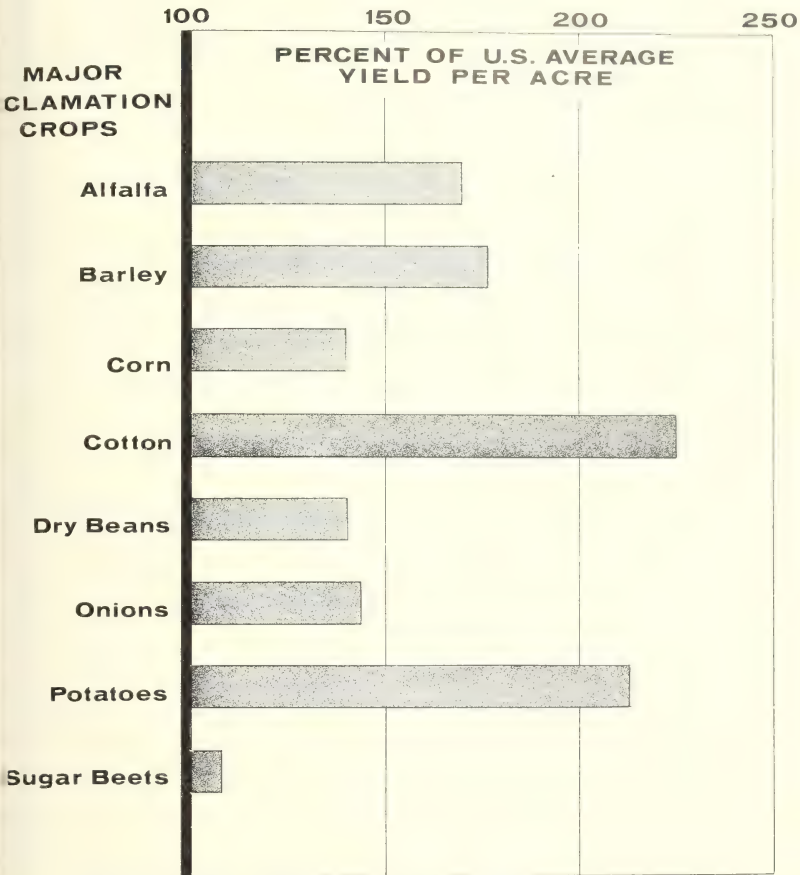
POPULATION TRENDS compared with AGRICULTURAL DEVELOPMENT 1880 - 1955



more than one-third of the sugar produced on the United States mainland. The average per-acre yield of sugar beets exceeded the 1956 figure by 6 percent and was greater than the previous 10-year average by 16 percent. Since 1940 the per-acre yield on Reclamation projects has increased by 35 percent. The projectwide average yield on the Columbia Basin project was 25.2 tons per acre. The projects had sugar beet yields exceeding 20 tons per acre. The returns for the crop, including the value of beet tops which are valuable for livestock feed, was \$91,312,122. Sugar beets on the Colorado-Big Thompson project alone had a total value of nearly \$25 million.

YIELDS OF RECLAMATION CROPS

Exceed U.S. Averages



Higher yields reflect improved resource development.

Acreage and gross crop value, 1957

| Crop group | Irrigated crops | | Gross crop value | |
|-----------------------------------|-----------------|------------------|------------------|------------------|
| | Acres | Percent of total | Dollars | Percent of total |
| Alfalfa | 1,710,143 | 26.08 | 112,404,817 | 12.11 |
| Barley | 2,987,263 | 45.56 | 155,517,940 | 16.76 |
| Crops, miscellaneous | 1,151,674 | 17.56 | 278,901,066 | 30.05 |
| Corn | 263,977 | 4.03 | 29,114,720 | 3.14 |
| Beans | 474,088 | 7.23 | 171,003,383 | 18.42 |
| Onions and nuts and miscellaneous | 317,033 | 4.83 | 155,220,221 | 16.72 |
| | | | 25,994,771 | 2.80 |
| Total reported | 6,904,178 | 105.29 | 928,156,918 | 100.00 |
| Multiple cropped | 486,754 | 7.42 | | |
| Soil-building crops | 20,845 | .32 | | |
| Land not harvested | 118,997 | 1.81 | | |
| Total | 6,557,266 | 100.00 | 928,156,918 | 100.00 |

Additional revenues from Federal and commercial agencies.

Some of the specialty type crops in this category had significant changes in 1957. Castor bean acreage increased 10 times, broom corn acreage increased 63 percent, and increases were also made in hops and mint acreage. Extra-long staple cotton, grown only in the Southwest under irrigation, more than doubled its acreage due to market demands and relaxation of acreage controls for this scarce premium fiber crop.

Repayment and Water Service Contracts

Contracts were executed in fiscal year 1958 with a considerable number of districts for the repayment of the cost of Reclamation projects. The distribution system loan repayment contract with the Terra Bella Irrigation District, Central Valley project, was the second loan repayment contract to be executed under the new loan program authorized by Public Law 130 of the 84th Congress (48 Stat. 244). This contract and the first loan repayment contract executed last year (Solano Irrigation District, Solano project, California) were both validated in the courts of California, and the United States began advancing funds on an approved schedule back to the two districts to permit local construction of distribution system works.

The Secretary of the Interior, on March 24, 1958, executed for the Government the first small Reclamation project loan repayment contract authorized by the Small Reclamation Projects Act of 1954. The contract which provides for repayment of \$4,600,000 over a period of 35 years is with the Cameron County Water Improvement District No. 1, located in the Lower Rio Grande Valley of Texas.

Repayment contracts covering rehabilitation and betterment programs were cleared for the Ogden River, Grand Valley, Salt River, Yakima (Sunnyside Division), North Platte (Goshen Irrigation District), and Sun River projects. The contract with the Salt River Water Users' Association for \$8 million is the largest R&B repayment contract to be executed in the history of the Bureau of Reclamation. Work covered by the contract will be carried out over a period of 8 years and will be repaid by the Association in 30 years.

An amendatory contract for the Paonia project was executed, thus clearing the way for continuation of construction of this project as a participating project of the Colorado River Storage project.

Late in the fiscal year, the Secretary approved the form of the proposed water service and repayment contract with the Uintah Water Conservancy District, Vernal Unit, Central Utah project, also a participating project of the Colorado River Storage project. This contract with the Uintah District is the first contract to be cleared

involving new construction for participating projects of the Colorado River Storage project.

Other payment contracts involving new construction which were entered included the contracts for the East Bench Unit of the Missouri River Basin project; various contracts for the Rogue River, Crooked River and Little Wood River projects; and the contract for the Mercedes Division of the Lower Rio Grande Rehabilitation project. The contract for the Mercedes Division provides for repayment of not to exceed \$10,800,000 in 40 years, and was approved by the Secretary of the Interior less than 6 weeks after the project was authorized.

Table 3 shows that the total value of repayment contracts on June 30, 1958, amounted to \$857,083,740. Of this amount a total of \$4,648,033 has been repaid and delinquencies were insignificant. In addition over \$125 million will be returned to the Government in water service payments under contracts now in force.

Land Openings

The Bureau conducted two land openings on two Reclamation projects, making available for settlement 51 farm units embracing 7,656 irrigable acres of new land. On the North Side pumping division of the Minidoka project in Idaho, 35 units were opened for settlement under the provisions of the Reclamation and homestead laws. The remaining 16 units were offered for sale on the Wellton-Mohawk division of the Gila project in Arizona.

Since the close of World War II, 59 land openings have been held on 4 Reclamation projects. A total of 2,735 new farm units encompassing approximately 242,650 irrigable acres of public land have been made available for selection by qualified applicants.

The availability of additional new farm units is anticipated during fiscal year 1959 on the Columbia Basin project in Washington. Additional privately owned lands in the Central Valley, Columbia Basin and Missouri Basin projects will be supplied with irrigation water. A considerable amount of this privately owned land may be available for sale by the owners as new irrigated farms.

Development Farms

Development farms are a very vital part of the settlement program on areas being newly developed for irrigation. The work is carried on in cooperation with various agriculture agencies and State agricultural colleges.

TABLE 3.—*Repayment contracts—matured and unmatured, June 30, 1958*

| Project and State | Value of repayment contracts | | | Unmatured value of repayment contracts | | | Matured value of repayment contracts | Amount due and unpaid |
|--|------------------------------|-------------------------------|---------------|--|------------------|-------------------------------|--------------------------------------|-----------------------|
| | Construction | Rehabilitation and betterment | Total | Construction | Deferred charges | Rehabilitation and betterment | Total | |
| PROPERTY TITLED IN UNITED STATES | | | | | | | | |
| Avondale, Idaho..... | \$244,423.61 | | \$244,423.61 | \$244,423.61 | | | \$244,423.61 | |
| Baker, Oregon..... | 225,014.54 | | 225,014.54 | 30,775.74 | \$20,193.25 | | 100,968.99 | \$124,045.55 |
| Balmorhea, Texas..... | 255,600.00 | | 255,600.00 | 228,990.50 | | | 228,990.50 | 26,609.50 |
| Belle Fourche, South Dakota..... | 4,230,059.65 | | 4,230,059.65 | 2,640,565.95 | | | 2,640,565.95 | 1,589,493.70 |
| Bitter Root, Montana..... | 1,052,741.05 | | 1,277,741.05 | 660,936.51 | | \$219,375.00 | 880,311.51 | 397,429.54 |
| Boise, Idaho-Oregon..... | 28,268,576.86 | 2,225,000.00 | 30,493,576.86 | 14,216,745.05 | 1,014,276.35 | 2,225,000.00 | 17,456,021.40 | 13,037,555.46 |
| Boulder Canyon: All-American Canal system, California..... | 52,444,205.61 | | 52,444,205.61 | 51,081,158.39 | | | 51,081,158.39 | 1,363,047.22 |
| Buffalo Rapids, Montana..... | 1,376,326.20 | | 1,376,326.20 | 1,287,097.43 | | | 1,287,097.43 | 89,228.77 |
| Burnt River, Oregon..... | 599,735.00 | | 599,735.00 | 314,849.56 | | | 314,849.56 | 284,885.44 |
| Cachuma, California..... | 5,800,000.00 | | 5,800,000.00 | 5,794,886.00 | | | 5,794,886.00 | 5,114.00 |
| Carlsbad, New Mexico..... | 3,721,944.04 | 25,000.00 | 3,746,944.04 | 1,742,107.13 | 64,070.00 | 22,500.00 | 1,828,677.13 | 1,918,266.91 |
| Central Valley, California..... | 63,683,022.35 | | 63,683,022.35 | 63,383,428.99 | | | 63,383,428.99 | 299,593.36 |
| Chief Joseph Dam, Foster Creek Division, Washington..... | 1,373,200.00 | | 1,373,200.00 | 1,373,200.00 | | | 1,373,200.00 | |
| Colbran, Colorado..... | 1,070,000.00 | | 1,070,000.00 | 1,070,000.00 | | | 1,070,000.00 | |
| Colorado-Big Thompson, Colorado..... | 26,032,704.85 | | 26,032,704.85 | 26,032,534.37 | | | 26,032,534.37 | 170.48 |
| Colorado River, Texas..... | 5,510,500.00 | | 5,510,500.00 | 5,510,500.00 | | | 5,510,500.00 | |
| Columbia Basin, Washington..... | 87,549,400.06 | | 87,549,400.06 | 87,476,217.55 | | | 87,476,217.55 | 73,182.51 |
| Crescent Lake Dam, Oregon..... | | 320,000.00 | 320,000.00 | | | 320,000.00 | | 454.05 |
| Dalton Gardens, Idaho..... | 258,659.63 | | 258,659.63 | 258,659.63 | | | 258,659.63 | |
| Deschutes, Oregon..... | 12,757,159.80 | | 12,757,159.80 | 12,407,019.22 | | | 12,407,019.22 | 350,140.58 |
| Eden, Wyoming..... | 1,500,000.00 | | 1,500,000.00 | 1,500,000.00 | | | 1,500,000.00 | |
| Fort Sumner, New Mexico..... | 2,432,166.55 | | 2,432,166.55 | 2,280,156.15 | | | 2,280,156.15 | 152,010.40 |
| Frenchtown, Montana..... | 297,282.04 | | 297,282.04 | 222,321.63 | | | 222,321.63 | 74,960.41 |
| Frutegrowers Dam, Colorado..... | 198,240.71 | | 198,240.71 | 131,423.97 | | | 131,423.97 | 66,816.74 |
| Grand, Arizona..... | 48,116,167.45 | | 48,116,167.45 | 48,067,181.28 | | | 48,067,181.28 | 48,986.17 |
| Gila Valley, Colorado..... | 2,124,314.37 | 1,958,327.73 | 4,082,642.10 | 1,211,453.07 | | 1,917,827.73 | 3,129,280.80 | 953,361.30 |
| Humboldt, Nevada..... | 1,211,244.68 | | 1,334,244.68 | 678,053.58 | | 26,902.68 | 827,956.26 | 506,288.42 |
| Huntley, Montana..... | 1,839,673.68 | 100,000.00 | 1,939,673.68 | 643,676.39 | 90,529.08 | 100,000.00 | 834,205.47 | 1,105,468.21 |
| Hyrum, Utah..... | 944,046.36 | | 944,046.36 | 632,731.45 | | | 632,731.45 | 311,314.91 |
| Intake, Montana..... | 46,900.00 | | 46,900.00 | 40,953.00 | | | 40,953.00 | 5,947.00 |
| Kendrick, Wyoming..... | 600,000.00 | | 600,000.00 | 600,000.00 | | | 600,000.00 | |
| Klamath, Oregon-California..... | 7,796,949.60 | | 7,837,149.86 | 4,373,761.87 | | | 4,544,798.61 | 3,292,351.25 |
| Lewiston, Orchards, Idaho..... | 2,500,000.00 | 40,200.26 | 2,500,000.00 | 2,393,839.30 | 144,906.74 | 26,130.00 | 2,393,839.30 | 106,160.70 |
| Lower Yellowstone, Montana-North | | | | | 949,076.40 | | | 949,076.40 |

| | | | | |
|-------------------------------------|----------------|---------------|----------------|------------|
| Mimboka, Idaho-Wyoming | 21,790,200.12 | 4,420,960.75 | 1,039,283.36 | 1,017.10 |
| Mirage Flats, Nebraska | 841,917.53 | 778,247.53 | 63,670.00 | 211.00 |
| Missoula Valley, Montana | 45,000.00 | 43,734.00 | 1,266.00 | |
| Missouri River Basin | 35,958,164.00 | 35,957,011.70 | 1,152.30 | |
| Moon Lake, Utah | 1,592,267.76 | 995,167.35 | 597,100.41 | |
| Newlands, Nevada | 3,257,749.35 | 371,580.19 | 2,886,169.16 | |
| Newton, Utah | 350,000.00 | 262,500.00 | 87,500.00 | |
| North Platte, Nebraska-Wyoming | 5,779,590.40 | 3,776,741.28 | 2,002,849.12 | 2,414.20 |
| Ogden River, Utah | 20,236,173.73 | 9,395,319.08 | 16,620,445.05 | |
| Ogden River, Nebraska | 4,734,935.11 | 3,788,839.79 | 1,426,095.32 | |
| Okanogan, Washington | 468,597.85 | 335,243.94 | 259,353.91 | |
| Oriand, California | 2,475,662.15 | 1,352,492.79 | 1,645,582.59 | 7,650.05 |
| Owyhee, Oregon-Idaho | 19,826,659.47 | 17,080,921.93 | 2,745,372.54 | 59,132.85 |
| Palisades, Idaho | 7,301,675.00 | 7,301,675.00 | | |
| Palo Verde, California-Arizona | 1,175,000.00 | 1,163,250.00 | | |
| Paonia, Colorado | 2,320,000.00 | 2,320,000.00 | | |
| Pine River, Colorado | 1,500,000.00 | 1,135,400.00 | | |
| Preston Bench, Idaho | 453,000.33 | 453,000.33 | 11,750.00 | |
| Provo River, Utah | 32,566,367.69 | 28,614,262.89 | 3,952,104.80 | |
| Rapid Valley, South Dakota | 500,000.00 | 362,500.00 | 137,500.00 | 4,750.00 |
| Rathdrum Prairie, Idaho | 855,909.19 | 782,739.29 | 73,169.90 | |
| Rio Grande, New Mexico-Texas | 10,144,123.26 | 2,113,965.71 | 7,243,010.68 | |
| Riverton, Wyoming | 7,008,987.07 | 6,299,984.30 | 709,002.77 | |
| Rogue River-Talent division, Oregon | 3,810,000.00 | 3,810,000.00 | | |
| Salt River, Arizona | 17,482,687.89 | 4,319,958.60 | 14,207,095.16 | |
| San Luis Valley, Colorado | 2,520,000.00 | 2,520,000.00 | | |
| Sanpete, Utah | 373,375.94 | 205,146.54 | 165,854.40 | |
| Santa Maria, California | 13,969,000.00 | 13,969,000.00 | | |
| Scofield, Utah | 247,000.00 | 156,600.00 | 90,400.00 | |
| Shoshone, Wyoming-Montana | 6,799,165.48 | 3,965,898.28 | 2,826,302.92 | |
| Strawberry Valley, Utah | 3,349,423.92 | 605,108.35 | 2,744,315.57 | |
| Sun River, Montana | 9,937,003.48 | 8,044,205.01 | 1,895,798.47 | 58,274.99 |
| Truckee Storage, Nevada | 1,021,603.00 | 624,660.42 | 396,942.58 | |
| Tuacumcari, New Mexico | 5,901,896.86 | 5,840,735.74 | 61,141.12 | 4,458.63 |
| Umatilla, Oregon | 1,463,822.22 | 973,949.51 | 487,872.71 | |
| Uncolpangre, Colorado | 6,892,511.84 | 5,565,014.01 | 1,327,497.83 | |
| Vale, Oregon | 5,022,287.50 | 4,438,955.66 | 583,331.84 | |
| Ventura River, California | 30,900,000.00 | 30,900,000.00 | | |
| Vernicejo, New Mexico | 2,107,943.33 | 2,107,943.33 | | |
| W. C. Austin | 3,262,188.49 | 2,608,160.00 | 654,028.49 | |
| Wapinitia, Oregon | 546,130.00 | 546,130.00 | | |
| Washita Basin, Oklahoma | 23,991,500.00 | 23,991,500.00 | | |
| Weber River, Utah | 57,694,000.00 | 57,694,000.00 | | |
| Weber River, Washington | 2,685,871.83 | 705,543.24 | 1,980,328.59 | 4,528.21 |
| Yakima, Washington | 46,497,633.59 | 32,295,116.65 | 14,426,780.32 | 4,901.76 |
| Yuma, Arizona, California | 5,354,257.83 | 146,558.34 | 5,207,699.49 | 5,543.04 |
| Yuma Auxiliary, Arizona | 1,563,874.77 | 970,138.16 | 593,716.61 | |
| Subtotal, United States Title | 828,240,812.21 | 23,842,411.17 | 134,124,382.16 | 231,601.73 |

TABLE 3.—*Repayment contracts—matured and unmatured, June 30, 1958—Continued*

| Project and State | Value of repayment contracts | | | Unmatured value of repayment contracts | | | | Matured value of repayment contracts | Amount due and unpaid |
|---|------------------------------|-------------------------------|----------------|--|------------------|-------------------------------|----------------|--------------------------------------|-----------------------|
| | Construction | Rehabilitation and betterment | Total | Construction | Deferred charges | Rehabilitation and betterment | Total | | |
| PROPERTY TITLED IN WATER USERS | | | | | | | | | |
| Arnold, Oregon..... | | \$197,925.82 | \$197,925.82 | | | \$164,304.51 | \$164,304.51 | \$33,621.31 | |
| Grand Valley, Colorado..... | | 1,183,966.49 | 1,183,966.49 | | | 539,995.71 | 539,995.71 | 643,970.78 | |
| Grants Pass (S. R. D.), Oregon..... | | 808,794.56 | 808,794.56 | | | 793,794.56 | 793,794.56 | 15,000.00 | |
| Ochoco, Oregon..... | | 500,000.00 | 500,000.00 | | | 500,000.00 | 500,000.00 | | |
| Palo Verde Diversion, Arizona-California..... | | 500,000.00 | 500,000.00 | | | 485,000.00 | 485,000.00 | 15,000.00 | |
| Rogue River Basin, Oregon..... | | 1,712,000.00 | 1,712,000.00 | | | 1,712,000.00 | 1,712,000.00 | | |
| Umatilla, Oregon..... | | 97,830.24 | 97,830.24 | | | 50,169.31 | 50,169.31 | 47,660.93 | |
| Subtotal, Water Users Title..... | | 5,000,517.11 | 5,000,517.11 | | | 4,245,264.09 | 4,245,264.09 | 755,253.02 | |
| Total repayment contracts..... | \$828,240,812.21 | 28,842,928.28 | 857,083,740.49 | \$692,929,304.01 | \$2,828,994.52 | 26,447,806.78 | 722,204,105.31 | 134,879,635.18 | \$231,601.73 |

† \$190,756.04 repaid by September 30, 1958.



ONION SEED.—This closeup view of an onion seed field on the Bureau of Reclamation Gila project in Arizona shows another type of crop raised on irrigated lands in the West. The Reclamation harvest from 77 projects in 1957 was valued at more than \$928 million.

During fiscal year 1958, there were 12 development farms in operation on the Columbia Basin, Gila, and Missouri River Basin projects. Several new farms are proposed for the latter project. There were development farms discontinued, bringing the total to 16 farms which have served their purpose since this program was started in 1947.

Weed Control

The ideal growing conditions created by irrigation also create one of the major problems in operating and maintaining an irrigation system, that of plants growing where they are not wanted. Science is playing an important part in solving the weed control problem.

A comprehensive weed control research program is conducted by the Agricultural Research Service, Department of Agriculture, in cooperation with the Bureau. This work has been accomplished at field stations at Phoenix, Ariz.; Prosser, Wash.; Bozeman, Mont.; and Laramie, Wyo., and in the Assistant Commissioner and Chief Engineer's weed control laboratory in Denver. The laboratory work has

been expanded to a team of four with two each from the Agricultural Research Service and the Bureau of Reclamation.

The more effective and economical weed control methods thus developed are put into practice as soon as they are thoroughly tested. Many of these are proving very effective in reducing the problems caused by undesirable vegetation and in decreasing operation and maintenance costs.

Under the provisions of the Halogeton Glomeratus Control Act of July 14, 1952, the Bureau is cooperating in the control of the poisonous weed Halogeton on Bureau lands in Utah, Nevada, Colorado, Wyoming, Montana, and Idaho.

Cooperation With Other Agencies

The Bureau of Reclamation has cooperated with other agencies so that their special skills, services, experience, and equipment may be utilized in Bureau operations. Several of the Bureau's activities in planning, developing, and operating its irrigation projects have been accomplished or facilitated through this plan.

The work is accomplished by means of agreements between the Bureau and the other agencies involved. These include, principally, units of the Department of Agriculture, State colleges, and extension services. However, they often include other Federal, State, and local agencies.

During fiscal year 1958, there were over 200 such cooperative agreements in effect. They include studies and investigations conducted on development farms, conservation and efficient use of soil and water, crop and cropping problems, assistance to county agricultural agents, and weed control studies. They cover also the development and management of reservoir recreational areas, financial aid to new settlers, and assistance in solving many other problems pertaining to the development of irrigation projects.

Soil and Moisture Operations

Operations for the conservation of soil and moisture on lands under its jurisdiction have been continued during the past year by the Bureau of Reclamation.

Progress has been made in the protection of land from wind and water erosion, reduction of moisture losses from land and water areas, and the protection of Reclamation built structures from the adverse effects of soil erosion. Some projects have been finished and new ones started. The work included structural installations, revegetation, and other means of erosion control and stabilization.

The work is planned, financed, and carried out in cooperation with the Federal agencies and with State and local agencies including water users' organizations.

ENGINEERING AND CONSTRUCTION

Fiscal year 1958 was highlighted by the award of contracts for construction of the Flaming Gorge Dam and powerplant in Utah and Navajo Dam in New Mexico, major features of the Colorado River Storage project. These structures together with the Glen Canyon Dam placed under construction in Arizona in 1957 are the principal elements in the 4-State project which will lead to the development of the land, water, and other resources of the Upper Colorado River Basin.

GRAND COULEE DAM, GIANT OF THE WESTERN WORLD.—Electric power for industry and commerce and life-giving water for almost 400,000 acres of land in the Pacific Northwest are provided by the massive Bureau of Reclamation structure and powerplant on the Columbia River in Washington State. The display of colored floodlights, shown in this night view, is a nationally famous tourist attraction.



Navajo Dam on the San Juan River in New Mexico will be the Bureau of Reclamation's second largest earthfill dam, exceeded in size only by the Trinity Dam under construction on the Central Valley project in California.

Palisades Dam on the Snake River in Idaho was completed and the final two generating units of the 114,000-kilowatt powerplant placed in service. Glendo Dam in Wyoming, Lovewell Dam in Kansas, and Helena Valley Dam in Montana, were also completed as were more than 200 miles of canals and laterals and related water conveyance facilities in Kansas and Nebraska.

Monticello Dam was completed on the Solano project in California and Haystack Dam on the Deschutes project in Oregon.

Other fiscal year events included start of construction of Vega Dam on the Collbran project, Colorado; Fort Cobb Dam on the Washita project, Oklahoma; Keene Creek Dam and Green Springs power conduit on the Rogue River Basin project, Oregon; and Robles Diversion Dam and a section of the Robles-Casitas Diversion Canal on the Ventura River project, California.

Major construction and supply contracts (more than \$1,000,000) awarded by the Bureau of Reclamation in fiscal year 1958 are listed in table 4.

TABLE 4.—Major Bureau of Reclamation contracts awarded in fiscal year 1958

| Feature | Project | Amount awarded |
|---|---|----------------|
| Flaming Gorge Dam, powerplant, and access roads..... | Colorado River storage..... | \$29,600,000 |
| Navajo Dam and access roads..... | do..... | 22,800,000 |
| Bulk portland cement for Glen Canyon Dam and powerplant..... | do..... | 9,700,000 |
| Foundations and steel towers for 310 miles of Fort Peck-Dawson County-Bismarck 230-kv. transmission line..... | Fort Peck and Missouri River Basin..... | 5,200,000 |
| 33 miles of pipelines for Casitas Gravity, Oak View, Ojai Valley, Rincon, and other water mains..... | Ventura River..... | 5,200,000 |
| Fort Cobb Dam..... | Washita Basin..... | 3,100,000 |
| 200 residences for Page, Ariz..... | Colorado River storage..... | 3,100,000 |
| Keene Creek Dam and Green Springs power conduit..... | Rogue River Basin..... | 2,800,000 |
| Concrete lining for 10 miles of Esquatzel diversion canal..... | Columbia Basin..... | 2,600,000 |
| Flaming Gorge community facilities and 80 residences..... | Colorado River storage..... | 2,600,000 |
| Enlargement of Emigrant Dam..... | Rogue River Basin..... | 2,600,000 |
| Bulk pozzolan for Glen Canyon Dam and powerplant..... | Colorado River storage..... | 2,400,000 |
| Penstock header and outlet pipe for Trinity Dam..... | Central Valley..... | 2,300,000 |
| Vega Dam and relocation of county road..... | Collbran..... | 1,700,000 |
| Concrete canal lining for 4.5 miles of Putah South Canal and 2.4 miles of Green Valley conduit, and 2 earth dams..... | Solano..... | 1,600,000 |
| Robles Diversion Dam and 4 miles of Robles-Casitas Diversion Canal..... | Ventura River..... | 1,500,000 |
| 13 miles of Driftwood Canal, 2 miles of Driftwood Subcanal, and 2.4 miles of laterals..... | Missouri River Basin..... | 1,300,000 |
| Streets and water distribution and sewage collecting systems for Page, Ariz..... | Colorado River Storage..... | 1,300,000 |
| Concrete lining for Wahluke Branch Canal laterals, waste-ways, and drains..... | Columbia Basin..... | 1,300,000 |
| Concrete canal lining for 8.9 miles of Howard Prairie Delivery Canal..... | Rogue River Basin..... | 1,300,000 |
| First stage earthwork for Willard Dam..... | Weber Basin..... | 1,300,000 |
| Water supply system for Page, Ariz..... | Colorado River Storage..... | 1,000,000 |

A total of 21 contracts, principally for electrical equipment, awarded to companies offering equipment manufactured outside

United States. This compares with 26 contracts awarded to foreign manufacturers in 1957 and 41 contracts awarded in 1956. The fiscal year 1958 contracts, which totaled \$965,867, were awarded to 7 Italian, 7 West German, 3 English, 1 Swiss, 1 French, 1 Austrian, and 1 African firms.

Principal features completed on Bureau of Reclamation projects during fiscal year 1958 are shown in table 5. The listing includes 7 large dams, 3 diversion dams, 1 powerplant in full production, 25 pumping plants, and 726 miles of canals, pipelines, laterals, sublaterals, and drains.

TABLE 5.—Principal features completed on Bureau of Reclamation projects in fiscal year 1958

| Feature | Project | State |
|---|-----------------------------|---------------------|
| 3 miles canals, laterals, wasteways, and drains..... | Columbia Basin..... | Washington. |
| 1 pumping plants..... | do..... | Do. |
| 1 Brewster Flat Pumping Plants..... | Chief Joseph Dam..... | Do. |
| 2 miles pipelines for Brewster Flat Distribution System..... | do..... | Do. |
| 1 track Dam..... | Deschutes..... | Oregon. |
| 1 Rio-Nyssa Pumping Plant..... | Owyhee..... | Do. |
| 1 Indian Falls Pumping Plant and 3 relief pumping plants..... | Michaud Flats..... | Idaho. |
| 3 miles canals, laterals, wasteways, and drains..... | do..... | Do. |
| 1 Palisades Dam and powerplant..... | Palisades..... | Do. |
| 1 miles pipelines for Hayden Lake Distribution System..... | Rathdrum Prairie..... | Do. |
| 1 mile Deadwood Tunnel..... | Rogue River Basin..... | Oregon. |
| 1 miles pipeline laterals and sublaterals and 3 pumpplants for Shafter-Wasco Irrigation District Distribution System..... | Central Valley..... | California. |
| 1 McCall Dam..... | Solano..... | Do. |
| 1 Diversion Dam..... | do..... | Do. |
| 1 Verde Diversion Dam..... | Palo Verde..... | Arizona-California. |
| 1 view Dam enlargement..... | Weber Basin..... | Utah. |
| 1 ville Diversion Dam..... | do..... | Do. |
| 1 es of Davis Aqueduct..... | do..... | Do. |
| 1 es of laterals, sublaterals, wasteways, and drains..... | Eden..... | Wyoming. |
| 1 diversion tunnel, Glen Canyon Dam..... | Colorado River Storage..... | Arizona. |
| 1 es of access road to Glen Canyon Dam..... | do..... | Do. |
| 1 es channelization of Rio Grande River..... | Middle Rio Grande..... | New Mexico. |
| 1 to Dam..... | Missouri River Basin..... | Wyoming. |
| 1 well Dam..... | do..... | Kansas. |
| 1 ia Valley Dam..... | do..... | Montana. |
| 1 es Courtland Canal, laterals, wasteways, and drains..... | do..... | Kansas. |
| 1 es of Upper Meeker Canal, laterals, wasteways, and drains..... | do..... | Nebraska. |
| 1 es of Kirwin North and South Canals, laterals, wasteways, and drains..... | do..... | Kansas. |
| 1 es of Sargent Canal, laterals, wasteways, and drains..... | do..... | Nebraska. |
| 1 es access roads and county road relocations forondo Dam..... | do..... | Wyoming. |

Construction costs on Bureau of Reclamation projects decreased about 2 percent during fiscal year 1958. Increased bidding interest and competition among bidders were responsible for the decrease in construction costs, although wage rates and most material and equipment prices continued to rise during this period.

Bidding interest in Bureau of Reclamation construction work showed a substantial increase over the preceding fiscal year, rising from an average of 5.8 bids per construction schedule in fiscal year

1957 to over 8 bids per schedule for the second half of fiscal year 1958.

Table 6 shows cost indexes for Bureau of Reclamation construction work based on the combined costs of materials and labor supplied by the contractors and materials and labor supplied by the Government.

TABLE 6. *Bureau of Reclamation construction indexes, fiscal year 1958*

| Cost indexes based on January 1940 costs=1.00 | July 1957 | January 1958 | July 1958 |
|---|-----------|--------------|-----------|
| Dams: | | | |
| Earth..... | 2.44 | 2.46 | |
| Concrete..... | 2.43 | 2.45 | |
| Pumping plants: | | | |
| Building and equipment..... | 3.01 | 3.01 | |
| *Structures and improvements..... | 3.10 | 3.14 | |
| Equipment..... | 2.86 | 2.86 | |
| Pumps and prime movers..... | 2.99 | 2.99 | |
| Accessory electric and miscellaneous equipment..... | 2.68 | 2.68 | |
| Steel penstocks and discharge pipes..... | 3.75 | 3.75 | |
| Canals and conduits: | | | |
| Canals..... | 2.61 | 2.57 | |
| Conduits (tunnels, free-flow, concrete-lined)..... | 2.92 | 2.94 | |
| Laterals and drains..... | 3.19 | 3.19 | |
| Powerplants, hydro: | | | |
| Building and equipment..... | 2.91 | 2.93 | |
| *Structures and improvements..... | 3.03 | 3.10 | |
| Equipment..... | 2.84 | 2.82 | |
| Turbines and generators..... | 2.84 | 2.84 | |
| Accessory electrical equipment..... | 2.72 | 2.72 | |
| Miscellaneous equipment..... | 2.81 | 2.73 | |
| Concrete pipelines..... | 2.34 | 2.36 | |
| Transmission switchyards and substations..... | 2.96 | 2.96 | |
| Transmission lines (wood-pole 115-kv.)..... | 2.22 | 2.34 | |
| Transmission lines (steel tower 230-kv.)..... | 2.73 | 2.73 | |
| Permanent general property: Buildings..... | 2.96 | 2.94 | |
| Roads and bridges: | | | |
| Primary roads..... | 2.60 | 2.58 | |
| Secondary roads, unsurfaced..... | 2.40 | 2.36 | |
| Bridges (steel)..... | 3.31 | 3.31 | |
| Composite index..... | 2.73 | 2.76 | |

*Indexes for structures and improvements on pumping plants and powerplants are based on a reinforced concrete structure.

Progress in Construction

On the Columbia Basin project in Washington, irrigation facilities were completed to serve an additional 45,000 acres, bringing the total to 351,000 acres. Completed were 301 miles of canals, laterals, waterways, and drains, and 17 pumping plants, including the Evergreen, Frenchman Springs, and White Bluffs pumping plants. Construction of the 15-foot diameter, 3-mile long Wahluke siphon was essentially completed at year's end.

In Idaho, construction of the American Falls pumping plant for the Michaud Flats project was completed.

Construction of the Green Springs powerplant structure on the Talent Division of the Rogue River Basin project in Oregon was essentially completed. The 16,000-kilowatt powerplant will be the Bureau's highest head powerplant, operating under a 1,800-foot head.

about 600 feet higher than any existing Reclamation powerplant. Work continued on other project features, including the first and second sections of the Howard Prairie Delivery Canal, Soda Creek Diversion Dam, and Little Beaver Creek Feeder Canal.

The structure of the 11,250-kilowatt Roza powerplant on the Yakima project in Washington was completed during the year, and installation of the generator and control equipment was well advanced. The plant is expected to be placed in commercial operation early fiscal year 1959.

On the Central Valley project in California, several major construction undertakings proceeded on the project's Trinity River Diversion which will ultimately make possible the average annual basin diversion of 865,000 acre-feet of surplus waters from the Trinity River watershed to the Central Valley Basin. Principal features of the diversion are the 537-foot high earthfill Trinity Dam and the 10.8 mile long, 17.5 foot diameter Clear Creek Tunnel. The pier at the dam—which will be the world's highest of its type—was

BOAT RACING ON THE PRAIRIES is an unusual and spectacular result of the construction of Bureau of Reclamation dams and reservoirs in the arid and semi-arid 17 Western States. These boat races at the dedication of Lovewell Dam on the Missouri River Basin project in Kansas show one feature of recreational opportunities at Reclamation projects enjoyed by millions of people each year.



diverted late in the year and foundation cleanup work was begun. Placement of the 33 million-cubic yard embankment was scheduled to begin early in the next fiscal year. Excellent progress was made on Clear Creek Tunnel, second longest tunnel on a Bureau of Reclamation project; the tunnel was about 50 percent excavated by the end of the year.

Other construction activities on the Central Valley project included completion of construction of 108 miles of pipeline laterals and sublaterals and 3 pumping plants for the Shafter-Wasco Irrigation District on the Friant-Kern Canal Distribution System, and started construction of 12.5 miles of pipelines for the Unit 1 extension to the Southern San Joaquin Municipal Utility District.

In Utah, the enlargement of Pineview Dam and the construction of Slaterville Diversion Dam on the Weber Basin project were completed, and construction of the 1,400-kilowatt Wanship powerplant was essentially completed. Also completed were the last section of the 22-mile long Davis Aqueduct, and the East Bountiful and South Davis pumping plants. Other project work continued on the West Farmington and Woods Cross trunklines, connected to the Davis Aqueduct, and on the 4,000-kilowatt Gateway powerplant.

Also in Utah, the 4,950-kilowatt Deer Creek powerplant on the Provo River project was completed and placed in commercial operation.

On the Middle Rio Grande in New Mexico, channelization of the Rio Grande was carried on under six separate contracts embracing 50 miles of channel. Four of the contracts totaling 34 miles were completed, and the remaining two contracts for 16 miles of channel were about 50 percent completed at the end of the year. Also completed was the rehabilitation of the Cochiti Diversion Dam, Angostura Diversion Works, and existing irrigation systems for the Belen Units 2, 3, 4, 5, and 6, totaling 49 miles of laterals, wasteways, and acequias (irrigating ditches).

In Wyoming, construction advanced toward completion of the 24,000-kilowatt Glendo powerplant. Work continued also on the 48,000-kilowatt Fremont Canyon powerplant and the 3-mile long, 1-foot diameter power conduit. In the same State, construction continued on the 203-foot high, concrete arch Anchor Dam.

In Montana, the 7-foot diameter, 2.6-mile long Helena Valley project tunnel was holed through in January 1958, and placement of concrete tunnel lining began the following month. Construction of the Helena Valley pumping plant was advanced to about 65 percent of completion. Work on the first 8-mile section of the Helena Valley Canal was about 90 percent completed by year's end, and the second 23-mile section of the canal was about 60 percent completed.

A construction milestone on the Missouri River Basin project was completion of the Sargent Unit in Nebraska. All work on the final 5-mile section of the Sargent Canal and 37 miles of laterals, wasteways, and drains was completed. The Sargent Unit was dedicated in the year. Work in progress during the year on the project's Benchman-Cambridge Division, also in Nebraska, embraced approximately 102 miles of canals, laterals, wasteways, and drains. Of this total, about 30 miles of structures have been completed, and the remaining 72 miles of canals and related structures were about 50 percent completed.

Postwick Division work on the project in Kansas was noted by the completion of the fourth 8-mile section and fifth 6-mile section of the Courtland Canal. The 10-mile long Courtland West Canal was about two-thirds completed. Also in Kansas, on the Kirwin Unit, 32 miles of the Kirwin North and South Canals and 31 miles of their lateral systems, wasteways, and drains were completed. Construction of the Goodston Diversion Dam was started.

Construction activities under the Transmission Division of the Missouri River Basin project included the start of work on the 310-mile long, 230-kv. steel tower transmission line which will run from the Fort Peck powerplant in Montana to Bismarek, N. Dak. At the river's end, the foundations were completed and the steel towers erected for the 67-mile, 230-kv. Utica Junction-Sioux Falls Transmission Line in South Dakota; stringing of conductors was scheduled to begin in early in fiscal year 1959. Work was about 70 percent completed on the 165-mile, 230-kv. steel tower transmission line between Fargo, N. Dak., and Granite Falls, Minn.

Construction of the 4,500-kilowatt Big Thompson powerplant on the Colorado-Big Thompson project in Colorado was about three-fourths completed by the end of the fiscal year. The powerplant will bring to completion the planned development of the transmountain diversion project.

Design Activities and Developments

Increased use of automatic computing devices in design was made during the year. Utilization of an electronic digital computer greatly facilitated design calculations of arch thicknesses at 10-foot horizontal and 7.5-foot vertical intervals for both the Glen Canyon and Flaming Gorge Dams; the resultant cost was approximately one-tenth of the cost of carrying out the calculations by conventional methods. Similar machine processing of data in access highway design led to establishing proper grades and optimum balance be-

tween cut and fill quantities at one-fifth the expenditure of time required by the engineers' usual methods of calculation.

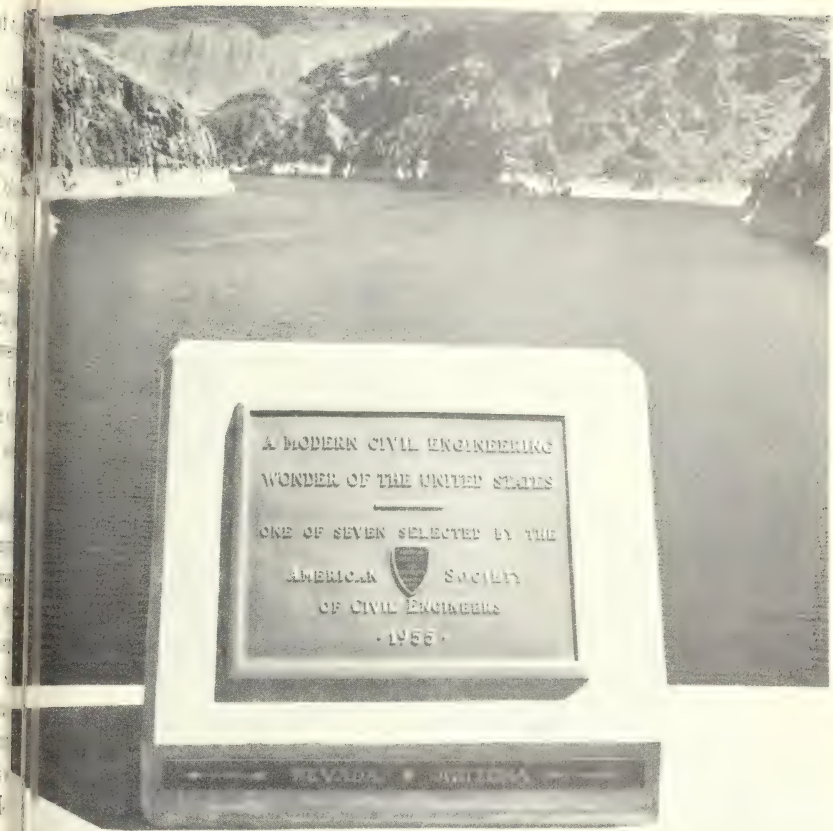
Increased emphasis was given during the year toward electrical designs which will permit greater automatic control of powerplant control systems. Economies in operation will be realized at the Thompson powerplant (Colorado-Big Thompson project, Colorado) and Green Springs powerplant (Rogue River Basin project, Oregon) which were designed to operate unattended through remote supervisory controls and which will have "pushbutton" starting and stopping controls. Similarly, designs were completed for the Roza powerplant (Yakima project, Washington) and Deer Creek powerplant (Provo River project, Utah) to operate on an "on-call" basis. Operation of the plants is automatic; operators living nearby serve only to start and stop the plants and periodically inspect equipment, and are available for emergencies.

Continued progress was made in investigating the feasibility of controlling evaporation from open reservoirs by the use of an invisible chemical layer, or monomolecular film. During the year's investigations, the water surface of a 150-acre reservoir was covered with a highly compressed layer of hexadecanol (cetyl alcohol) for significant periods of time, and a method of spraying hexadecanol slurry was developed at the 1,000-acre Carter Lake on the Colorado-Big Thompson project. Arrangements were completed with the city of Oklahoma City to conduct full-scale evaporation control tests using hexadecanol early next fiscal year at the 2,500-acre Lake Hefner, part of the city's municipal water supply system. If the Lake Hefner tests are successful, potentially millions of gallons of water lost annually by evaporation from reservoirs may be saved.

Laboratory investigations of materials and methods to reduce the costs of canal linings were continued during the year. Included in the studies were sediment, soil-cement, concrete, asphalt, and prefabricated asphalt linings. Representative specimens from approximately 60 samples of assorted plastic products submitted by manufacturers during the past 10 years were tested as possible materials adaptable to low cost prefabricated canal linings. The tests indicate that the more common polyethylene and vinyl plastic films of 0.001 inch minimum thickness are potentially satisfactory materials for buried membrane canal linings.

During the year, 121 laboratory reports were issued covering research and testing of concrete and concrete materials, earth materials research, structural studies, hydraulic laboratory investigations, and research in bituminous construction and protective coatings.

Publications issued during the year included the technical record on the design and construction of Hungry Horse Dam and powerplant.



ONE OF SEVEN MODERN WONDERS is Hoover Dam on the lower Colorado River. Selected for this title by the American Society of Civil Engineers, the 726-foot high dam—built by the Bureau of Reclamation—controls the formerly rampaging river and furnishes hydroelectric power and water for the irrigation of valuable specialty crops in southern California and southwestern Arizona. Lake Mead, formed by the dam, serves as backdrop for the ASCE bronze plaque.

Canyon Ferry Dam and powerplant, Jamestown Dam, Trenton Dam, Holders Dam, and Eklutna Dam, tunnel, and powerplant, and the remaining three volumes of the comprehensive four volume technical record of the Colorado-Big Thompson project, covering dams and reservoirs, waterways, and power and pumping plants. An extensive revision of the Power System Safety Handbook, which provides standards and procedures on safety for employees of the Bureau of Reclamation engaged in the operation and maintenance of power systems, was also published.

In response to 5,980 requests for the Bureau's publications and informational materials received from individuals in this country and

in foreign countries, more than 30,000 copies of technical publications and informational pamphlets were sold or distributed. Sales of Bureau publications totaled \$24,916, approximately one-half of total being made to foreign countries. Sales of publications sold by the Superintendent of Documents totaled \$5,650.

HYDROELECTRIC POWER DEVELOPMENT

In order to utilize to the greatest advantage the energy resources made available by multipurpose reservoirs, the Bureau of Reclamation has constructed and, as of June 30, 1958, operated 37 powerplants with an installed nameplate capacity of 5,093,500 kilowatts. In addition, the Bureau is responsible for marketing the power generated at the powerplants constructed by the Corps of Engineers and the International Boundary and Water Commission, with a total installed nameplate capacity of 776,500 kilowatts.

Sale of electric power by the Bureau during the year aggregated 29,233,973,619 kilowatt-hours, with revenues from sales totaling \$71,132,535.72, as shown on table 7.

TABLE 7.—Bureau of Reclamation power systems, power sales, and revenues from projects, fiscal year ending June 30, 1958

| Projects | Sales of electric energy, kilowatt-hours ¹ | Revenues from sales |
|--|---|---------------------|
| Boise..... | 193,427,757 | \$441,774 |
| Boulder Canyon..... | 4,716,873,519 | 10,367,446 |
| Central Valley..... | 3,594,842,802 | 12,866,277 |
| Columbia Basin ² | 12,316,202,000 | 12,921,955 |
| Eklutna..... | 157,250,328 | 1,570,233 |
| Falcon..... | 78,365,700 | 251,733 |
| Fort Peck..... | 190,824,816 | 893,238 |
| Hungry Horse ² | 786,955,300 | 3,757,889 |
| Minidoka..... | 153,242,191 | 698,367 |
| Missouri River Basin Integrated System, Eastern Division..... | 3,131,878,307 | 11,482,888 |
| Missouri River Basin Integrated System, Western Division, ³ | 1,164,873,450 | 7,083,300 |
| North Platte..... | 102,780,312 | 663,404 |
| Palisades..... | 455,970,574 | 1,422,000 |
| Parker-Davis..... | 2,000,183,378 | 6,054,367 |
| Provo River Basin..... | 8,130,114 | 24,111 |
| Rio Grande..... | 83,261,868 | 378,004 |
| Yakima ² | 88,197,778 | 223,509 |
| Yuma..... | 10,713,425 | 31,604 |
| Grand total..... | 29,233,973,619 | 71,132,535.72 |

¹ Does not include energy sales and revenues in transactions between Bureau projects.

² Deliveries to and revenues from Bonneville Power Administration included as follows:

| | | |
|---------------------|---------------------|--------------|
| Columbia Basin..... | 11,698,079,650 kw-h | \$12,612,300 |
| Hungry Horse..... | 784,793,000 kw-h | 3,752,000 |
| Yakima..... | 88,174,500 kw-h | 223,000 |
| Total..... | 12,571,047,150 kw-h | 16,587,300 |

³ Includes systems of Riverton, Shoshone, Colorado-Big Thompson, and Kendrick projects.

Hydroelectric powerplants which are now an additional source of energy as a result of water conservation works had the following nameplate capacity installed during the year:

| | |
|---|------------------|
| Palisades project (Units 1 and 4)..... | Kilowatts 57,000 |
| Provo River Basin (Deer Creek—Units 1 and 2)..... | 4,000 |

Fiscal Year Expansion

During fiscal year ending June 30, 1958, the installed nameplate capacity of hydroelectric powerplants at Bureau of Reclamation multiple-purpose projects and at projects for which the Bureau is responsible for marketing the power, increased 61,950 kilowatts over the fiscal year 1957 figures.

Additional Capacity Under Construction

At the end of fiscal year 1958, the Bureau of Reclamation had under construction 9 powerplants, which will have an ultimate installed nameplate capacity of 1,117,150 kilowatts. They are listed below:

| Plant | Project | River | State | Nameplate capacity (kw.) |
|----------------|------------------------|-------------------|------------|--------------------------|
| Big Canyon | Colorado River Storage | Colorado | Arizona | 900,000 |
| Big Thompson | Colorado-Big Thompson | Big Thompson | Colorado | 4,500 |
| Green Springs | Rogue River Basin | Emigrant Creek | Oregon | 16,000 |
| Greening Gorge | Colorado River Storage | Green | Utah | 108,000 |
| Haystack | Weber Basin | Weber | do | 4,000 |
| Highway | do | do | do | 1,400 |
| Idaho | Yakima-Roza | Yakima-Roza Canal | Washington | 11,250 |
| Idaho | Missouri River Basin | North Platte | Wyoming | 24,000 |
| Mont Canyon | do | do | do | 48,000 |

The United States Army Corps of Engineers is proceeding with the construction of additional plants in the Missouri River Basin. The ultimate installed nameplate capacity of Oahe powerplant in South Dakota will be 595,000 kilowatts. The Bureau of Reclamation will be the marketing agent for energy generated from this plant. This is the case for other plants constructed by the Corps on the Missouri River Basin project.

Hydroelectric Powerplants

The hydroelectric powerplants constructed and operated by the Bureau of Reclamation and powerplants for which the Bureau is the marketing agent are listed in table 8.

Transmission System

To provide the electrical energy for the Bureau's projects and to market the power which is surplus to the Bureau's needs, a transmission system including powerplant substations, switchyards, and transmission lines, has been constructed. As of June 30, 1958, the installed transformer capacity of the individual substations operated by the Bureau was nearly 11 million kilovolt-amperes.

TABLE 8.—*Hydroelectric powerplants*

A. CONSTRUCTED AND OPERATED BY BUREAU OF RECLAMATION

| State or Territory | Project | Name of plant | Calendar year of initial operation | Nameplate rating | |
|--------------------|----------------------------|---------------------------|------------------------------------|----------------------|----------------------|
| | | | | Existing (kilowatts) | Ultimate (kilowatts) |
| 1. Alaska | Eklutna | Eklutna | 1955 | 30,000 | 30,000 |
| 2. Alaska | do | Old Eklutna ¹ | 1955 | 2,000 | 2,000 |
| 3. Arizona-Nevada | Boulder Canyon | Hoover ² | 1936 | 1,249,800 | 1,340,000 |
| 4. Arizona-Nevada | Parker-Davis | Davis | 1951 | 225,000 | 225,000 |
| 5. Arizona-Nevada | do | Parker | 1942 | 120,000 | 120,000 |
| 6. California | Central Valley | Folsom | 1955 | 162,000 | 162,000 |
| 7. California | do | Keswick | 1949 | 75,000 | 75,000 |
| 8. California | do | Nimbus | 1955 | 13,500 | 13,500 |
| 9. California | do | Shasta | 1944 | 379,000 | 379,000 |
| 10. California | Yuma | Siphon Drop | 1926 | 1,600 | 1,600 |
| 11. Colorado | Colorado-Big Thompson | Estes | 1950 | 45,000 | 45,000 |
| 12. Colorado | do | Flatiron | 1954 | 71,500 | 71,500 |
| 13. Colorado | do | Green Mountain | 1943 | 21,600 | 21,600 |
| 14. Colorado | do | Marys Lake | 1951 | 8,100 | 8,100 |
| 15. Colorado | do | Polehill | 1954 | 33,250 | 33,250 |
| 16. Colorado | Grand Valley | Grand Valley ³ | 1932 | 3,000 | 3,000 |
| 17. Idaho | Boise | Anderson Ranch | 1950 | 27,000 | 40,000 |
| 18. Idaho | do | Black Canyon | 1925 | 8,000 | 8,000 |
| 19. Idaho | do | Boise Diversion | 1912 | 1,500 | 1,500 |
| 20. Idaho | Minidoka | Minidoka | 1909 | 13,400 | 13,400 |
| 21. Idaho | Palisades | Palisades | 1957 | 114,000 | 114,000 |
| 22. Montana | Missouri River Basin | Canyon Ferry | 1953 | 50,000 | 50,000 |
| 23. Montana | Hungry Horse | Hungry Horse | 1952 | 285,000 | 285,000 |
| 24. New Mexico | Rio Grande | Elephant Butte | 1940 | 24,300 | 24,300 |
| 25. South Dakota | Missouri River Basin | Angostura | 1951 | 1,200 | 1,200 |
| 26. Utah | Provo River | Deer Creek | 1958 | 4,950 | 4,950 |
| 27. Washington | Columbia Basin | Grand Coulee | 1941 | 1,974,000 | 1,974,000 |
| 28. Washington | Yakima, Kennewick Division | Chandler | 1956 | 12,000 | 12,000 |
| 29. Wyoming | Kendrick | Alcova | 1955 | 36,000 | 36,000 |
| 30. Wyoming | do | Seminole | 1939 | 32,400 | 32,400 |
| 31. Wyoming | Missouri River Basin | Boysen | 1952 | 15,000 | 15,000 |
| 32. Wyoming | do | Kortes | 1950 | 36,000 | 36,000 |
| 33. Wyoming | North Platte | Guernsey | 1927 | 4,800 | 4,800 |
| 34. Wyoming | do | Lingle ⁴ | 1919 | 1,400 | 1,400 |
| 35. Wyoming | Riverton | Pilot Butte | 1925 | 1,600 | 1,600 |
| 36. Wyoming | Shoshone | Heart Mountain | 1948 | 5,000 | 5,000 |
| 37. Wyoming | do | Shoshone | 1922 | 5,600 | 5,600 |
| Subtotal A. | | | | 5,093,500 | 5,202,000 |

B. CONSTRUCTED AND OPERATED BY OTHERS—POWER MARKETING BY BUREAU OF RECLAMATION

| State or Territory | Project | Name of plant | Calendar year of initial operation | Existing (kilowatts) | Ultimate (kilowatts) |
|--------------------|-----------------------------|---------------|------------------------------------|----------------------|----------------------|
| 1. Montana | Fort Peck (USCE) | Fort Peck | 1943 | 85,000 | 162,000 |
| 2. North Dakota | Missouri River Basin (USCE) | Garrison | 1956 | 240,000 | 400,000 |
| 3. South Dakota | do | Fort Randall | 1954 | 320,000 | 320,000 |
| 4. South Dakota | do | Gavins Point | 1956 | 100,000 | 100,000 |
| 5. Texas | Falcon (IBWC) | Falcon | 1954 | 31,500 | 40,000 |
| Subtotal B. | | | | 776,500 | 1,022,000 |

¹ Acquired from City of Anchorage on completion of Eklutna Project FY 1955. This plant however not operated.

² Powerplant units operated by Southern California Edison Co. and City of Los Angeles Dept. of Water and Power as agents of the U. S.

³ Leased to Public Service Co. of Colorado for operation.

⁴ On Non-operating status from May 1, 1956.

USCE—United States Corps of Engineers.

IBWC—International Boundary and Water Commission.

During fiscal year 1958 there were 121 contracts executed for the sale of power or for transmission service or other purposes. Included in these 121 contracts were various types as follows:

Number of contracts:

| | Type of customer |
|---------|-------------------------------|
| 21----- | Private utilities. |
| 36----- | REA cooperatives. |
| 28----- | Municipalities. |
| 7----- | Federal agencies. |
| 3----- | Public power districts. |
| 6----- | State authorities. |
| 12----- | Irrigation districts. |
| 8----- | Miscellaneous type contracts. |

A number of contracts executed were renewals of operating contracts or revisions of existing contracts resulting from changed operating conditions.

The Bureau continued its policy of contracting whenever possible with private utilities, public bodies, and cooperatives for wheeling power and energy over existing facilities. The Bureau also entered into several interchange agreements with its customers.

A summary by classification of customers served by Reclamation during fiscal year 1958 is shown in table 9.

TABLE 9.—Summary by classification of customers for 12 months ending June 30, 1958¹

| Type of customers | Number of customers | Sales of electric energy | Revenues from sales |
|--|---------------------|--------------------------|---------------------|
| | | <i>Kilowatt-hours</i> | |
| ately owned utilities..... | 34 | 5,354,206,253 | \$15,888,121.54 |
| micipal utilities..... | 102 | 2,433,947,313 | 7,568,570.39 |
| e Government utilities..... | 12 | 4,457,091,745 | 14,607,005.42 |
| operative utilities (Rural Electrification Administration projects)..... | 92 | 1,807,840,756 | 9,609,804.58 |
| Other Federal utilities ² | 8 | 12,655,560,477 | 17,001,703.04 |
| idential and domestic..... | 288 | 5,940,104 | 33,296.28 |
| ul (other than Rural Electrification Administration projects)..... | 7 | 124,240 | 811.48 |
| mmercial and industrial..... | 22 | 101,689,461 | 522,686.67 |
| ic authorities..... | 76 | 1,539,731,526 | 4,944,033.90 |
| departmental..... | 44 | 877,841,744 | 956,502.42 |
| Total all customers..... | 685 | 29,233,973,619 | 71,132,535.72 |

¹ Does not include energy sales and revenues in transactions between Bureau projects.

² Totals include 12,571,047,150 kilowatt-hours delivered to Bonneville Power Administration for marketing and \$16,587,430 in payments by that agency.

The Bureau at the end of fiscal year 1958 had 75 contracts under active negotiation. In this number are included 29 contracts with municipalities, 18 with REA cooperatives, 16 with private utilities, 5 with public power districts, 5 with other Federal agencies, 2 with State authorities, and 1 miscellaneous type contract. A number of these are to renew the existing contracts, or to revise contracts in existence due to changes in operating conditions.

PROJECT DEVELOPMENT

The project development program involves preparation of comprehensive plans for development of river basin resources and the investigation and planning of individual potential projects and unification of projects for the conservation and optimum utilization of the water resources of the West. It also includes detailed preconstruction studies on newly authorized projects.

Comprehensive Basin Surveys

During 1958, the Bureau of Reclamation in cooperation with other agencies was engaged in comprehensive surveys in eight river basins throughout the West as well as in basinwide activities such as technical assistance in interstate river basin compact negotiations and operations in several other basins. In addition, comprehensive studies were active in 13 subbasins of the Missouri River Basin project, including the Bad Division in North Dakota for which a final report was completed.

THE HIGHEST STEEL-ARCH HIGHWAY BRIDGE in the world spans the Colorado River at Page, Ariz., 700 feet above the site of Glen Canyon Dam now under construction as a major storage feature on the Bureau of Reclamation Colorado River Storage project for the development of vast land and natural resources in the Four-State Upper Colorado River Basin.



Work continued on the permanently authorized investigations program in Alaska.

Project Planning Reports

By the end of the fiscal year, feasibility reports had been submitted to Congress on the Spokane Valley project and the Greater Welch Division of the Chief Joseph Dam project in Washington; the El Jardin and the Mercedes Divisions of the Lower Rio Grande Rehabilitation project in Texas; and the Molokai project in Hawaii. Reports submitted to the Bureau of the Budget included a coordinated report of the Bureau of Reclamation and the Bureau of Indian Affairs on the San Juan-Chama project and the Navajo Indian Irrigation project in Colorado and New Mexico; reports on the Garrison Diversion Unit, North Dakota and Red Willow Unit, Westwick Division, Kansas, of the Missouri River Basin Project; and the La Feria Division, Lower Rio Grande Rehabilitation project, Texas. The report on the La Feria Division was subsequently referred for reexamination of the proposed plan of development at the request of the local interests.

Planning reports which were being reviewed or were transmitted in review by States and Federal agencies prior to submission to the Bureau of the Budget include those on the Vale project, Bully Creek Extension, Oregon; and the Cheney Division, Wichita project, Kansas.

Definite Plans

During the fiscal year definite plans for authorized projects were completed and approved on the Almena Unit, Nebraska, of the Missouri River Basin project; Foss Dam and Reservoir of the Washita Basin project in Oklahoma; the Vernal Unit, Central Utah project in Utah; and the Paonia project in Colorado. The last two participating projects of the Colorado River Storage project.

Loan Program

Four applications for loans under the Small Reclamation Projects Act of 1956 totaling \$9,437,000 were approved and sent to the Congress during the year. The contract for one of these, that of the Cameron County Water Control and Improvement District No. 1 of Marlingen, Tex., was executed and has been validated during the fiscal year. Three more applications totaling \$5,262,000 were examined and were nearly ready for submission to the Congress by the end of the year. Six others were under consideration and if approved

these would provide loans totaling about \$19,820,000. A number of other organizations were actively preparing applications and the Bureau of Reclamation has been cooperating with them to assure better reports on their proposals. A great deal of interest has developed in these loans and 59 organizations have formally indicated their intent to apply for loans totaling about \$116,000,000.

A loan of \$1,900,000 was made to the Terra Bella Irrigation District in the Central Valley project of California for the construction of an irrigation distribution system under the provisions of Public Law 130, 83d Congress. The contract for this loan has been executed and validated by the court. Three other applications for similar loans totaling \$10,545,500 were under consideration during the year. Funds were not available for these three loans so final approval has not been given and the contracts have not been executed.

River Compacts

The Bear River Compact was approved by the President on May 17, 1958. The Klamath River Compact was approved by the President on August 30, 1957. The Columbia River Compact was modified on August 6, 1956, and has been resubmitted to the State Legislatures of Washington, Oregon, Idaho, Montana, Wyoming, Utah, and Nevada for ratification. There was no further action during this fiscal year.

Hydrology

The Branch of Hydrology continued its study of hydrologic problems associated with proposed Reclamation projects to assure that maximum use and conservation will be obtained from the water resources so developed. In all multiple-purpose reservoirs, studies are made to develop operational criteria for the optimum benefit from the standpoint of irrigation, flood control, hydropower, recreation, fish and wildlife resources, and sediment control.

Cooperative work with various Federal, State, and local agencies is continuing on the development, study, and evaluation of water spreading devices and detention reservoirs on the Upper Cheyenne River with the purpose of prolonging the useful life of Angostura Reservoir.

Channelization investigations were conducted on the Provo, Middle Rio Grande, and Lower Colorado Rivers. Water salvage is also a major aim of the Middle Rio Grande plans, while flood control is an objective in the Provo River studies.



CITRUS FRUITS, TOO.—This aerial view of young citrus groves in the Yuma Mesa Division of the Bureau of Reclamation Gila project in Arizona shows another type of irrigated land production. The total area in the 17 Western States subject to irrigation service from the 77 Reclamation projects was 7,827,598 acres in 1957.

Development of a radioisotope instrument for measuring sediment densities has progressed to a stage that the instrument is now being used in resurveys of reservoirs.

PROGRAM COORDINATION AND FINANCE

Schedules

Project data sheets were developed for inclusion in the fiscal year 1959 budget material submitted to the Bureau of the Budget and the Congress. These data sheets present in concise, easy-to-read tabular form the historical and economic data which formerly were presented in rather lengthy narrative form.

Complete revision of the Reclamation Instructions relating to allotments and apportionments was necessitated by revised regulations of the Bureau of the Budget and the adoption of new apportionment forms.

Progress was made toward further correlation of program scheduling, reporting, and finance activities.

Finance

Regional committees were established to investigate application of electronic data processing to some accounting and administrative operations. In one region, the payroll operation was centralized and placed on electronic data machines under contract with a private service bureau; other machine applications in an advanced stage of development include (1) processing of power bills, (2) real property inventory records, and (3) completion of historical data on personnel services. Paralleling these developments, studies were continued to refine and up-date the accounting procedural instruction series and to centralize in regional offices, certain field accounting operations.

Budget

Appropriations for all purposes made available to the Bureau of Reclamation for fiscal year 1958 totaled \$199,974,223. This amount included \$10,000,000 in supplemental funds each for the Trinity River division of the Central Valley project and the Glen Canyon unit of the Colorado River storage project. Permanent appropriations or revolving funds are not included. The appropriation for 1958 exceeded the funds made available in 1957 by \$5,962,518.

With an unobligated balance of \$30.1 million carried over from fiscal year 1957 for construction, investigations and the loan program plus funds advanced by water users, trust funds, a continuing fund for emergency expenses, Fort Peck project and new appropriations the total amount available to Reclamation was \$235.2 million. Of this amount there remained unobligated at the close of 1958 from construction, investigations and the loan program funds an amount of \$10.1 million. These funds are available in fiscal year 1959.

Obligations for 1958 totaled \$225.1 million or 96 percent of the obligations programed as compared to 92 percent of the program accomplished in 1957.

The Appropriation Act for 1958 again prohibited initiating construction on transmission facilities in areas covered by power wheeling contracts unless the wheeling agencies were unable or unwilling to provide the service. The act also repeated the limitation upon the amount of money that may be expended for construction work by Government forces (force account work). This limitation provided that not to exceed 12 percent of the allotment for any one project or Missouri River Basin unit, or \$225,000 for any one project or unit, was to be used.

The amounts appropriated by activity for fiscal year 1958, together with the amounts to be derived from the special and general fund are as follows:

TABLE 10.—Source and disposition of the reclamation fund, June 30, 1958

| | Amount | Percent |
|---|---------------|---------|
| SOURCE | | |
| Contributions: | | |
| Sale of public lands..... | \$134,010,982 | 10.10 |
| Royalties from oil leases..... | 380,573,713 | 28.65 |
| Royalties and rentals from potassium leases..... | 15,155,832 | 1.14 |
| Federal waterpower licenses..... | 1,583,230 | .11 |
| Miscellaneous..... | 13,161 | |
| Total accretions..... | 531,336,918 | 40.00 |
| Collections: | | |
| Construction repayments..... | 128,201,256 | 9.65 |
| Operation and maintenance repayments..... | 64,004,244 | 4.82 |
| Power revenues..... | 446,534,201 | 33.62 |
| Water rental..... | 61,203,279 | 4.61 |
| Miscellaneous revenues..... | 34,935,553 | 2.63 |
| Total collections..... | 734,898,533 | 55.33 |
| Reimbursements: | | |
| Intra bureau financing..... | 33,047,615 | 2.50 |
| Office of Indian Affairs..... | 2,997,829 | .23 |
| Colorado River front work and levee system..... | 829,976 | .06 |
| Returned to fund..... | 25,000,000 | 1.88 |
| Total..... | 1,328,110,871 | 100.00 |
| DISPOSITION | | |
| For annual allotments and appropriations: | | |
| Construction and rehabilitation..... | 828,539,378 | 68.97 |
| Operation and maintenance..... | 237,558,553 | 19.78 |
| General investigations..... | 58,518,795 | 4.87 |
| General administrative expenses..... | 68,692,318 | 5.72 |
| Emergency fund..... | 2,900,000 | .24 |
| Total gross annual allotments and appropriations..... | 1,196,209,044 | 99.58 |
| Permanent appropriations..... | 1,217,408 | .10 |
| Payment of claims..... | 1,654,227 | .14 |
| Lapsed and expired appropriations returned to Treasury..... | (22,815,641) | (1.90) |
| Repayment of loans..... | 25,000,000 | 2.08 |
| Total..... | 1,201,265,038 | 100.00 |
| Residual (unallotted and unappropriated)..... | 126,845,833 | |

TABLE 11.—*Accretions to reclamation fund by States, fiscal year 1958*

| State | Sale of public land | | Proceeds from Oil Leasing Act | | Total June 30, 1958 |
|-------------------|---------------------|---------------------|-------------------------------|---------------------|---------------------------|
| | Fiscal year 1958 | To June 30, 1958 | Fiscal year 1958 | To June 30, 1958 | |
| Alabama..... | | | \$1, 778. 56 | \$213, 888. 57 | \$215, 667. 13 |
| Arizona..... | \$492, 396. 00 | \$3, 849, 640. 39 | 428, 784. 61 | 856, 943. 15 | 4, 706, 624. 15 |
| Arkansas..... | | | 10, 751. 13 | 48, 392. 75 | 58, 143. 88 |
| California..... | 1, 011, 931. 44 | 12, 683, 765. 57 | 4, 592, 339. 58 | 74, 513, 475. 70 | 87, 197, 776. 29 |
| Colorado..... | 190, 297. 17 | 11, 668, 282. 68 | 6, 287, 928. 89 | 41, 884, 928. 23 | 53, 350, 438. 97 |
| Florida..... | | | 314. 61 | 2, 903. 65 | 3, 218. 26 |
| Idaho..... | 433, 781. 62 | 8, 907, 045. 79 | 244, 820. 11 | 1, 176, 118. 86 | 10, 084, 861. 36 |
| Illinois..... | | | | 74. 81 | 74. 81 |
| Kansas..... | 280. 16 | 1, 046, 576. 99 | 68, 724. 39 | 540, 325. 72 | 1, 587, 677. 16 |
| Louisiana..... | | | 194, 078. 87 | 1, 042, 579. 99 | 1, 236, 658. 86 |
| Michigan..... | | | 1, 956. 10 | 31, 682. 97 | 33, 639. 07 |
| Mississippi..... | | | 2, 582. 53 | 23, 637. 55 | 26, 220. 08 |
| Montana..... | 149, 179. 83 | 16, 622, 598. 15 | 2, 145, 329. 56 | 14, 864, 245. 55 | 31, 486, 772. 09 |
| Nebraska..... | 3, 782. 40 | 2, 219, 800. 57 | 4, 746. 92 | 76, 881. 54 | 2, 298, 731. 43 |
| Nevada..... | 256, 622. 53 | 2, 358, 603. 77 | 291, 229. 09 | 3, 716, 402. 91 | 6, 075, 838. 27 |
| New Mexico..... | 120, 527. 31 | 7, 515, 550. 85 | 7, 345, 997. 87 | 48, 886, 851. 45 | 56, 408, 426. 08 |
| North Dakota..... | 2, 542. 32 | 12, 289, 780. 37 | 138, 534. 18 | 1, 045, 382. 07 | 13, 337, 696. 92 |
| Oklahoma..... | 9, 129. 93 | 5, 980, 057. 95 | 29, 523. 95 | 287, 060. 66 | 6, 266, 641. 47 |
| Oregon..... | 728, 872. 50 | 16, 950, 477. 00 | 9, 698. 09 | 295, 164. 07 | 17, 248, 107. 66 |
| South Dakota..... | 9, 089. 54 | 7, 873, 728. 62 | 128, 882. 51 | 851, 503. 80 | 8, 722, 942. 47 |
| Utah..... | 40, 988. 32 | 5, 053, 382. 91 | 2, 947, 734. 78 | 16, 855, 283. 64 | 21, 904, 359. 65 |
| Washington..... | 253, 345. 40 | 9, 360, 393. 28 | 10, 107. 95 | 87, 558. 28 | 9, 443, 399. 91 |
| Wyoming..... | 87, 600. 79 | 9, 631, 297. 13 | 15, 553, 851. 85 | 143, 494, 127. 20 | 153, 122, 776. 97 |
| Total..... | 3, 790, 367. 26 | 134, 010, 982. 02 | 40, 439, 696. 13 | 350, 795, 413. 12 | 484, 806, 197. 27 |

| Other accretions | | Fiscal year 1958 | Total June 30, 1958 |
|---|--|---------------------|---------------------------|
| Proceeds, Federal waterpower licenses..... | | \$65, 993. 24 | \$1, 586, 670. 41 |
| Proceeds, potassium royalties and rentals..... | | 2, 708, 753. 77 | 15, 156, 778. 29 |
| Receipts from naval petroleum reserves, 1920-38, act of May 9, 1938..... | | | 29, 778. 12 |
| Proceeds from rights-of-way over withdrawn lands, act of July 19, 1919..... | | 535. 50 | |
| Miscellaneous items, other..... | | | |
| Miscellaneous mineral leasing permits..... | | 134. 00 | |
| Total..... | | 2, 775, 416. 51 | 46, 530, 226. 82 |
| Grand total..... | | 47, 005, 479. 90 | 531, 336, 424. 09 |

istics

Continuing with the Bureau's established routine, centralized statistical services were provided by which official statistical data maintained and furnished on (1) current and projected accomplishments on each of the Bureau's major activities, and (2) on historical and current legislative financial and personnel matters.

Data for (1) were made available through the regular Bureau's Monthly Report on Progress and Status of Funds, Forecast on Utilization of Funds, the Bureau's quarterly "Progress," fiscal year 1958 Annual Plan and related interim reports and special studies. Data (2) were covered by the various compilations prepared for the Annual Statistical Appendix to the Commissioner's Annual Report by publishing new 1957 editions of Reclamation Project Feasibilities and Authorizations, Reclamation Appropriation Acts and Allotments, Reclamation Repayments Federal Reclamation Laws, and related interim reports and special studies.

All together these data show a profile of Reclamation's activities in project planning through project feasibilities, authorizations, appropriations, expenditures, cost, repayments, investments, facilities features, irrigation development and crops, municipal and industrial water and power development and sales, and income and expense in operations.

TABLE 12.—Cost of plant, property, and equipment in each State, June 30, 1958

| State and project | Completed works | | | | Construction in progress | Other physical property | Grand total |
|--|-----------------|---------------|---------------|---------------|--------------------------|-------------------------|-----------------|
| | Multipurpose | Irrigation | Electric | Other plant | | | |
| Total | \$1,096,908,031 | \$970,057,845 | \$649,986,818 | \$27,800,014 | \$378,506,179 | \$23,304,537 | \$3,146,653,424 |
| Alaska: Eklutna | | | 32,367,921 | | 339,399 | | 32,707,320 |
| Arizona, subtotal | 90,470,339 | 60,085,862 | 108,558,603 | (F) 3,453,904 | 41,532,735 | 239,478 | 304,340,921 |
| Boulder Canyon: | | | | | | | |
| All-American Canal system (California) | 2,179,950 | | | | | | 2,179,950 |
| Hoover Dam and powerplant (Nevada) | 44,552,890 | | | | 2,325 | | 78,167,885 |
| Colorado River front work and levee system (California-Nevada) | | | 33,612,670 | | | | 3,453,904 |
| Colorado River storage: Glen Canyon Unit (Utah) | | 44,700,624 | | (F) 3,453,904 | 38,540,666 | | 38,540,666 |
| Gila | | | | | 1,353,274 | | 46,283,376 |
| Palo Verde (California) | | | | | 1,297,167 | | 1,297,167 |
| Parker-Davis (California-Nevada) | 38,658,287 | | 70,557,593 | | 1,369,303 | 239,478 | 109,585,183 |
| Salt River | 5,079,212 | 10,731,853 | 4,265,443 | | | | 20,077,508 |
| Yuma (California) | | 3,513,105 | 121,897 | | | | 3,635,002 |
| Yuma auxiliary | | 1,140,280 | | | | | 1,140,280 |
| California, subtotal | 326,388,438 | 198,473,917 | 119,098,205 | (F) 9,610,857 | 122,508,993 | | 776,080,410 |
| Boulder Canyon: All-American Canal system (Arizona) | | | | | | | |
| Cachuma | 38,658,820 | | | | | | 58,492,616 |
| Central Valley | 42,869,685 | 16,504,010 | | (F) 3,329,786 | 550,984 | | 43,420,669 |
| Colorado River front work and levee system (Arizona-Nevada) | 239,814,668 | 168,564,711 | 99,833,885 | | 59,150,402 | | 567,363,665 |
| Klamath (Oregon) | | | | | | | |
| Orland | | 6,410,411 | | (F) 6,281,071 | | | 6,281,071 |
| Palo Verde (Arizona) | | 2,583,870 | | | 246,012 | | 6,656,423 |
| Parker-Davis (Arizona-Nevada) | | | | | 135,452 | | 2,719,322 |
| Santa Maria | 5,045,265 | | 18,775,930 | | 3,013,996 | | 3,013,996 |
| Solano | | | | | 23,839,682 | | 23,839,682 |
| Loan program—distribution systems | | | | | 9,944,547 | | 9,944,547 |
| Truckee storage (Nevada) | | 1,092,423 | | | 33,908,272 | | 33,908,272 |
| Yentura River | | | | | 251,452 | | 251,452 |
| Yuma (Arizona) | | | | | 1,092,423 | | 1,092,423 |
| Yuma projects office—Yuma, Reservation division | | 3,318,492 | 488,390 | | 15,274,868 | | 15,274,868 |
| Colorado, subtotal | 53,416,560 | 104,306,758 | 40,490,372 | | 14,521 | | 3,806,882 |
| | | | | | | | 14,521 |

| | | | | | |
|--|--------------------|-------------------|-------------------|----------------|--------------------|
| Mancos..... | 3,915,063 | 719,926 | 575,518 | 152,251 | 3,915,063 |
| Missouri River Basin..... | 13,288,958 | | | | 14,584,402 |
| Paonia..... | 1,599,704 | | | | 1,751,955 |
| Pine River..... | 3,466,923 | | | | 3,466,923 |
| San Luis Valley..... | 3,869,520 | | 1,596 | | 3,871,116 |
| Uncompahgre..... | 8,965,960 | | | | 8,965,960 |
| Idaho, subtotal..... | 45,983,487 | 9,477,242 | 63,318,878 | 27,978 | 169,338,141 |
| Avondale..... | 244,424 | | | | 244,424 |
| Boise (Oregon)..... | 25,924,426 | 5,071,926 | 1,423,549 | | 65,518,642 |
| Dalton Gardens..... | 1,877,731 | | | | 258,660 |
| King Hill..... | 1,037,302 | | | | 1,877,731 |
| Lewiston Orchards..... | 426,999 | | | | 2,484,397 |
| Little Wood River..... | 2,012,019 | | 146,626 | | 146,626 |
| Michaud Flats..... | 16,256,259 | 3,130,422 | 1,567,516 | | 3,579,535 |
| Minidoka (Wyoming)..... | 967,179 | | 4,633,031 | 27,978 | 32,736,568 |
| Owyhee (Oregon)..... | 450,100 | 1,274,804 | 66,112 | | 1,033,291 |
| Palisades (Wyoming)..... | 3,768,869 | | 54,984,286 | | 60,028,049 |
| Preston Bench..... | 482,360 | | 497,758 | | 450,100 |
| Rahdrum Prairie..... | | 2,257,473 | 803,845 | | 980,118 |
| Iowa: Missouri River Basin transmission lines..... | 45,334,483 | | | | 3,061,318 |
| Kansas, subtotal..... | 13,953,756 | | 3,300,854 | | 62,589,093 |
| Garden City..... | 334,475 | | | | 334,475 |
| Missouri River Basin..... | 13,619,281 | | 3,300,854 | | 62,254,618 |
| Minnesota: Missouri River Basin transmission lines..... | 31,000,532 | 41,564,517 | 12,266,707 | 217,674 | 6,683,701 |
| Montana, subtotal..... | 121,404,576 | | | | 206,457,364 |
| Bitter Root..... | 1,052,873 | | 113,177 | | 1,166,050 |
| Buffalo Rapids..... | 4,925,179 | | 68,241 | | 4,991,420 |
| Fort Peck (North Dakota)..... | 279,321 | 10,430,045 | 409,809 | | 10,839,854 |
| Fredericktown..... | 1,820,328 | | 76,321 | | 279,321 |
| Hungry Horse..... | 94,213 | 22,177,848 | 541 | | 101,720,450 |
| Huntley..... | 3,031,353 | | | | 1,829,869 |
| Intake..... | 7,424,943 | | | | 94,213 |
| Lower Yellowstone (North Dakota)..... | 2,001,917 | | | | 3,031,353 |
| Milk River..... | 39,936,378 | 8,956,624 | 11,366,409 | 217,674 | 9,426,860 |
| Missoula Valley..... | 2,088,829 | | | | 278,321 |
| Missouri River Basin..... | 16,400 | | | | 62,569,272 |
| Shoshone (Wyoming)..... | 9,979,772 | | 234,209 | | 10,400 |
| Sun River..... | | | | | 10,213,981 |

See footnotes at end of table.

TABLE 12.—*Cost of plant, property, and equipment in each State, June 30, 1958—(Continued)*

| State and project | Completed works | | | | Construction in progress | Other physical property | Grand total |
|---|-----------------|--------------|-------------|---------------|--------------------------|-------------------------|---------------|
| | Multipurpose | Irrigation | Electric | Other plant | | | |
| Nebraska, subtotal | \$37,075,496 | \$48,880,097 | \$7,568,807 | | \$6,956,312 | | \$100,480,712 |
| Mirage Flats | | 3,061,614 | | | | | 3,061,614 |
| Missouri River Basin | 37,075,496 | 35,559,239 | 7,319,172 | | 6,956,312 | | 86,910,219 |
| North Platte (Wyoming) | | 10,259,244 | 249,635 | | | | 10,508,879 |
| Nevada, subtotal | 53,341,710 | 8,793,789 | 36,728,663 | (F) \$102,123 | 205,990 | \$7,495,731 | 106,668,006 |
| Boulder Canyon: | | | | | | | |
| Hoover Dam and powerplant (Arizona) | 49,898,544 | | 32,123,159 | | 140,427 | 1,710,803 | 83,872,933 |
| Boulder City Municipal | | | | | | 5,749,703 | 5,749,703 |
| Colorado River front work and levee system (California-Arizona) | | | | (F) | | | |
| Humboldt | | 1,278,335 | | | 59,520 | | 102,123 |
| Newlands | | 7,515,454 | 344,343 | | | 35,225 | 1,337,855 |
| Parker-Davis (Arizona-California) | | | 4,261,161 | | 6,043 | | 7,895,022 |
| Truckee Storage (California) | 3,443,166 | | | | | | 7,710,370 |
| New Mexico, subtotal | 17,014,140 | 39,480,342 | 7,996,394 | (F) 272,926 | 9,142,741 | | 73,906,543 |
| Carlsbad | 3,179,992 | 2,059,600 | | | | | 5,239,592 |
| Colorado River storage: Navajo unit (Colorado) | | | | | 1,210,777 | | 1,210,777 |
| Fort Sumner | | 2,372,004 | | | | | 2,372,004 |
| Hondo | | 339,376 | | | | | 339,376 |
| Middle Rio Grande | 4,274,530 | 12,146,842 | | | 7,705,333 | | 24,126,705 |
| Rio Grande (Texas) | 8,161,144 | 5,998,816 | | | 214,631 | | 22,643,911 |
| Tucumcari | | 15,474,082 | 7,996,394 | (F) | | | 15,474,082 |
| Vermejo | 1,398,474 | 1,089,622 | | | 12,000 | | 2,500,096 |
| North Dakota, subtotal | 8,392,723 | 3,413,124 | 30,440,272 | (FW) 41,559 | 1,163,255 | 123,213 | 43,574,146 |
| Buford-Trenton | | | | | 565 | | 1,090,464 |
| Buford-Trenton, old | | 1,089,899 | | | | | 223,423 |
| Fort Peck (Montana) | | 223,423 | 1,547,815 | | 1,141 | | 1,548,956 |
| Lower Yellowstone (Montana) | | 554,574 | | | | | 554,574 |
| Missouri River Basin | 8,392,723 | 1,136,133 | 28,892,457 | (FW) 41,559 | 1,161,549 | 123,213 | 39,747,634 |
| Williston | | 409,095 | | | | | 409,095 |
| Oklahoma, subtotal | 6,958,533 | 5,136,166 | | (M) 152,026 | 3,936,642 | | 16,183,367 |

| | | | | | | |
|--|------------|------------|--|--|--|----------------------|
| Baker..... | 225,015 | | | | | 225,015 |
| Boise (Idaho)..... | 4,275 | | | | | 4,275 |
| Burnt River..... | 601,026 | | | | | 601,026 |
| Crescent Lake Dam ¹ | | | | | | |
| Crooked River..... | | | | | | |
| Deschutes..... | | | | | | |
| Grants Pass—Savage Rapids Dam ¹ | 11,632,921 | 515,304 | | | | 852,754 1,264,268 |
| Grants Pass—Savage Rapids Dam, fish protection facilities..... | | | | | | |
| Klamath (California)..... | 8,039,634 | | | | | 200,042 8,187,364 |
| Ochoco ¹ | | | | | | |
| Owyhee (Idaho)..... | 17,965,280 | 91,965 | | | | 13,333 |
| Rogue River..... | | | | | | |
| Rogue River—Talent division..... | | | | | | |
| Umatilla..... | 5,142,388 | | | | | 18,303,000 |
| Vale..... | 4,866,824 | | | | | 976,829 |
| Wapinitia, Juniper division..... | | | | | | 9,088,852 |
| | | | | | | 5,157,666 |
| | | | | | | 4,866,824 |
| | | | | | | 151,500 |
| South Dakota, subtotal..... | 25,444,155 | 42,620,478 | | | | 73,630 |
| | | | | | | |
| Belle Fourche..... | | | | | | |
| Missouri River Basin..... | 24,523,931 | | | | | 5,038,107 |
| Rapid Valley..... | 920,224 | 42,620,478 | | | | 75,533,308 |
| | | | | | | 920,224 |
| Texas, subtotal..... | 23,439,644 | | | | | 28,477,559 |
| | | | | | | |
| Balmorhea..... | | | | | | |
| Colorado River..... | 23,439,644 | | | | | 406,533 |
| Falcon..... | | | | | | 23,439,644 |
| Rio Grande (New Mexico)..... | | | | | | |
| Utah, subtotal..... | 23,670,001 | 1,147,499 | | | | 4,631,382 |
| | | | | | | |
| Colorado River storage: Glen Canyon unit (Arizona)..... | | | | | | |
| Flaming Gorge unit (Wyoming)..... | | | | | | |
| Transmission division..... | | | | | | |
| Hyrum..... | | | | | | |
| Moon Lake..... | | | | | | |
| Newton..... | | | | | | |
| Ogden River..... | | | | | | |
| Provo River..... | | | | | | |
| Sanpete..... | | | | | | |
| Scotfield..... | | | | | | |
| Strawberry Valley..... | | | | | | |
| Weber Basin..... | | | | | | |
| Weber River..... | | | | | | |

See footnotes at end of table.

TABLE 12.—*Cost of plant, property, and equipment in each State, June 30, 1938—Continued*

| State and project | Completed works | | | Construction in progress | Other physical property | Grand total |
|---|-----------------|---------------|---------------|--------------------------|-------------------------|---------------|
| | Multipurpose | Irrigation | Electric | | | |
| Washington, subtotal | \$161,042,284 | \$261,115,580 | \$110,974,732 | \$39,713,475 | \$11,697,205 | \$584,817,619 |
| Chief Joseph Dam, Foster Creek | | | | | | |
| Columbia Basin | 151,627,777 | 213,992,294 | | 2,448,069 | | 2,448,069 |
| Okanogan | | 1,498,251 | 107,802,081 | 34,975,558 | 11,697,205 | 520,094,915 |
| Yakima | 9,414,507 | 45,625,035 | 3,172,651 | 7,069 | | 1,505,920 |
| Wyoming, subtotal | 57,531,453 | 64,792,166 | 52,628,724 | 2,282,179 | | 60,768,786 |
| Colorado River storage: Flaming Gorge unit (Utah) | | | | 22,008,224 | 974,174 | 197,934,741 |
| Eden | | 5,762,237 | | 1,605,621 | | 7,367,858 |
| Kendrick | | 10,125,964 | 15,529,019 | 11,940 | | 30,831,279 |
| Minidoka (Idaho) | 5,164,356 | 2,246,462 | | | | 2,246,462 |
| Missouri River Basin | 45,417,123 | 2,308,818 | 31,871,918 | 18,528,400 | 800 | 98,127,059 |
| North Platte (Nebraska) | 1,777,132 | 10,673,540 | 1,342,369 | 106,873 | | 13,899,914 |
| Pallsades (Idaho) | 680,574 | | | 159,996 | | 840,570 |
| Riverton | 2,932,183 | 17,394,448 | 475,891 | 843,806 | 973,374 | 22,619,702 |
| Shoshone (Montana) | 1,560,085 | 16,280,697 | 3,409,527 | 751,588 | | 22,001,897 |
| Nonproject property | | | | 77,731 | 2,228,784 | 2,306,515 |

¹ Construction costs classified as funded operation and maintenance charges.

at gross construction cost prior to deduction of chargeoffs authorized by Congress. Municipal and industrial water plant (M) totals \$14,040,873; flood control plant (F) totals \$13,439,810; and fish and wildlife (FW) totals \$319,331.

Notes.—Name of State in which balance of project is located is indicated by parentheses (except Missouri River Basin, located in 10 States). Irrigation plant is listed

TABLE 13. *Condensed statement of appropriations, fiscal year 1958, exclusive of trust funds and permanent appropriations*

| | | |
|---------------------------------|-------------|-------------|
| General investigations | | \$5,932,000 |
| Reclamation fund | \$5,182,000 | |
| Colorado River development fund | 500,000 | |
| General fund | 250,000 | |
| Construction and rehabilitation | | 126,736,223 |
| Reclamation fund | 55,000,000 | |
| General fund | 71,736,223 | |
| Colorado River basin fund | | 35,142,000 |
| General fund | 35,142,000 | |
| Operation and maintenance | | 28,000,000 |
| Reclamation fund | 22,740,000 | |
| Colorado River dam fund | 2,044,600 | |
| General fund | 3,215,400 | |
| General administrative expenses | | 4,164,000 |
| Reclamation fund | 4,164,000 | |
| Grand total | 199,974,223 | 199,974,223 |
| Reclamation fund | | 87,086,000 |
| Colorado River Dam fund | | 2,044,600 |
| Colorado River development fund | | 500,000 |
| General fund | | 110,343,623 |
| | | 199,974,223 |

CONTRACTS AND PROPERTY MANAGEMENT

Reclamation purchase orders and supply contracts totaling \$12,600,- were placed with small business firms during fiscal year 1958 as compared with \$9,100,000 during fiscal year 1957. Total procurement purchase orders and supply and service contracts increased from \$7,000,000 to \$31,100,000. The number of procurement actions decreased 5 percent from a total of 90,962 to 86,353.

Continuing emphasis was placed on motor vehicle fleet utilization and reduced operation and maintenance costs. The fleet was reduced from 3,430 vehicles in 1957 to 3,230 at the end of 1958, a reduction of 6 percent. Of this number, 76 were passenger-carrying vehicles. The fleet traveled 28,775,000 miles during 1957 at a cost (less depreciation) of \$80,000, or an average cost of \$0.0618 per mile; and in 1958, 27,671,000 miles at a cost of \$1,530,000, or \$0.0533 per mile. Based on fiscal year 1957 mileage, operation, and costs, this represents a savings of \$1,000.

Personal property with an acquisition cost of \$1,139,000 was declared surplus, of which \$1,079,000 was disposed of. This is almost double the value of property declared surplus in 1957.

Real property with an acquisition cost of \$1,854,000 was disposed of during 1958, eliminating the cost of management, operation, and main-

tenance of the property involved. Of this amount \$606,000 represents property returned to the tax rolls through sales as surplus to public need.

COMPTROLLER

Forty-five audit assignments were completed during the year. They comprised 36 comprehensive project audits; 2 audits of water user organizations, performed at their request; 4 special audits; and 3 miscellaneous assignments which resulted in informal letter reports.

Additionally, members of the Comptroller's staff were utilized to a great extent in work undertaken by the Committee on Reevaluation of Procedures and Factors for Replacement Reserves, operating from the Denver Office.

GENERAL SERVICES

During the fiscal year, the Bureau received and created 9,400 cubic feet of records; disposed of 9,453 cubic feet; transferred to Federal records centers and National Archives for custody and servicing 2,000 cubic feet; and transferred to other Government agencies, water user organizations, etc., 81 cubic feet. These resulted in a decrease in the volume of records held by all Bureau offices from 97,665 to 94,636 cubic feet. Approximate dollar savings in space and equipment costs as a result of destruction and transfers to low-cost space amounts to \$104,895.

In response to 5,980 requests for the Bureau's publications and information material received from individuals in this country and foreign countries, more than 30,000 copies of technical publications and informational pamphlets were distributed from Denver. Sales of Bureau publications at Denver totaled \$24,916, approximately one-half of this total being made to foreign countries. Sales of publications supplied by the Bureau as agent for the Superintendent of Documents totaled \$5,650.

In response to 867 requests, 11,908 copies of Bureau publications were distributed. Of these requests, 178 were of congressional origin for 720 publications and 178 were from agencies of the executive branch of the Federal Government for 1,420 copies.

Two thousand one hundred seventy-eight prints were provided for reproduction in Bureau publications, non-Government textbooks, encyclopedias, various agricultural and engineering magazines, newspapers, and to supplement exhibits and lectures. Requests by mail and in person for visual material were also received from congressional offices and from agencies of the executive branch of the Federal Government.

even hundred and thirty-six films were distributed to television stations, agricultural and engineering institutions, water users' associations, organizations of farmers, and to conventions in the United States and abroad.

ORGANIZATION AND METHODS

The following offices were established: Crooked River project office, Seaside, Oreg.; Wapinitia project office, Madras, Oreg.; and Grand Junction projects office, Grand Junction, Colo. The Deschutes project office, Culver, Oreg., and the Lower Yellowstone construction office, Bozeman, Mont., were closed.

Incentive awards activity increased by about 28.5 percent, a total of 1,419 suggestions for the improvement of Bureau activities and procedures being received during the year. Of these, approximately 60 percent were adopted and the employees who proposed the improvements were awarded \$14,395. These suggestions resulted in an estimated annual savings of \$145,709, in addition to substantial intangible benefits. Cash awards in recognition of superior performance were granted to 235 employees.

DIVISION OF PERSONNEL

During fiscal year 1958, Bureau employment declined from 10,506 full-time employees to 10,125. The reduction generally was the result of completion of work in some areas without compensating work increases in others. It was accomplished in an orderly manner and without use of reduction in force procedures. By careful advance scheduling a maximum number of employees from areas with declining programs were shifted to other areas. Staffing control was maintained through use of ceilings on employment of both permanent and seasonal employees.

Shortages of beginning engineers at the opening of the fiscal year required aggressive recruitment at colleges and universities. During the 1956-57 school year, 96 beginning professional engineers and 57 engineer student trainees were recruited. Direct recruitment costs amounted to less than \$150 per employee. College recruitment activities were curtailed in the spring of 1958 as requirements leveled off.

Work was commenced on a revision of Bureau promotion policies to bring them into line with the new Civil Service Commission merit promotion program. The new plan covering competitive positions at the Bureau will be in operation by January 1, 1959.

DIVISION OF FOREIGN ACTIVITIES

Increasing demands on the water resources of the world have caused continued requests for Bureau of Reclamation assistance to foreign governments in the development of these resources. Through several bilateral and multilateral technical assistance programs in which the U. S. Government participates, the facilities and personnel of the Bureau of Reclamation have been made available to fill the requirement to the fullest extent possible without interference with the domestic program. All such assistance has been financed from sources outside the regular Reclamation appropriation.

Training of foreign nationals in the specialized fields of engineering and administration related to water resource development was provided by the Washington, Denver, and field offices. During the year 122 individuals spent from 6 to 12 months in on-the-job training assignments, and 123 participants spent shorter periods of official observation with these offices. Representatives from 38 countries were included in this group. In addition there were over 200 accredited visitors and several hundred tourists, students, and other foreign nationals who stopped at various Bureau of Reclamation installations.

Under the program of the International Cooperation Administration, International Educational Exchange Service, and the United Nations, highly qualified engineers have traveled abroad to provide on-site assistance in a variety of problems. Fifteen people were on 2-year assignments to Australia, Ethiopia, Formosa, Lebanon, and Turkey. Short details of from 1 to 6 months were performed by 9 engineers in 11 countries.

LEGAL

During fiscal year 1958, which included approximately the last 6 months of the first session and the first 6 months of the second session of the 85th Congress, several legislative proposals of importance to the program of the Bureau of Reclamation were enacted into law.

Of interest generally are:

Public Law 85-156, which extended until December 31, 1960, some of the provisions of the Reclamation Project Act of 1939 authorizing the Secretary to negotiate amendatory repayment contracts and grant deferments in the payment of construction charges in hardship cases;

Public Law 85-433, which permits reimbursement of owners and tenants of lands for certain moving expenses, caused by land acquisitions for developments, including reclamation developments, under the jurisdiction of the Department.

The Congress enacted legislation authorizing the construction, operation, and maintenance of four units of the Greater Wenatchee Division of the Chief Joseph Dam project, Washington (Public Law 85-93), the San Angelo project, Texas (Public Law 85-152), and the Lower Rio Grande rehabilitation project, Texas, Mercedes division (Public Law 85-370). Additional construction was authorized in the Pecos River Basin, New Mexico and Texas (Public Law 85-333) and along the Colorado River (Public Law 85-389).

Authorization was granted to execute the repayment contract negotiated with the Casper-Alcova Irrigation District (Public Law 85-158), and congressional approval was granted amendatory repayment contracts with the Northport Irrigation District (Public Law 85-223) and the Mirage Flats Irrigation District (Public Law 85-300).

Of special interest is the enactment of Public Law 85-240 which was designed to facilitate the early incorporation of the town of Coulee under the laws of the State of Washington in order that the United States may withdraw from the administration of that community.

Litigation

Rank v. Krug, et al.—The history of this case appears in the 1956 Annual Report of the Secretary, page 62. Supplemental information appears in the 1957 Annual Report, page 88. The United States and its codefendants (water user organizations beneficiary of the operations of the Central Valley project, particularly as to operations at Friant Dam and Friant-Kern and Madera Canals) have appealed the case to the Ninth Circuit Court of Appeals. The complete record on appeal has not yet reached the offices of the Court of Appeals.

State of California v. United States, United States District Court for the Northern District of California, No. 7264.—This action was filed July 5, 1955, for damages totaling \$764,741.79, alleged to have been sustained by the State as a result of a sudden shutdown of the Bureau of Reclamation of releases down the Sacramento River from Shasta Reservoir. The rapid drawdown is alleged to have caused the collapse of levees, the repair and replacement of which is a partial responsibility of the State. The case is currently in the pretrial stage.

Citizens Utilities Company v. United States, and *California-Pacific Utilities Company v. United States*, United States Court of Claims (Nos. 364-55, 381-55).—The first named action was filed in the Court of Claims September 30, 1955, for damages totaling

\$12,216,775 alleged to have been sustained as a result of the wrongful and unlawful failure and refusal of the United States to renew contract for purchase of a portion of the Metropolitan Water District's unused Hoover Dam energy, which contract by express terms of limitation expired December 31, 1954.

On October 12, 1955, California-Pacific Utilities Company, holder of a similar energy contract which also by express terms of limitation expired December 31, 1954, filed a similar suit for \$4,579,807.

March 6, 1957, the Court of Claims decided in favor of the plaintiff.

Negotiations with California-Pacific Utilities Company for resumption of service culminated in the execution of a contract with the company on April 30, 1958, providing for the renewal to December 31, 1962, of the company's resale contract and for the future sale to the company of a quantity of power to be developed at powerplants of the Parker-Davis project. The contract contains an acquittance of all the company's claims against the United States arising out of the failure of the United States to renew the 1941 resale contract, and provides that the company will file a petition for dismissal with prejudice of the Court of Claims action. Pursuant to the latter provision, the company filed its Motion for Dismissal With Prejudice of the said action.

Negotiations with Citizens Utilities Company for the resumption of delivery of Metropolitan Water District unused energy to the company were carried on after the denial of certiorari. Agreement had not been reached on an arrangement which would dispose of all the issues between the company and the United States. However, on May 23, 1958, the company was advised that the United States was willing to resume deliveries of such energy on June 1, 1958, with the understanding that the respective positions of the company and the United States would not be prejudiced thereby. The company accepted the above offer and delivery to it was commenced on June 1, 1958.

4. *State of Arizona, Plaintiff v. State of California, et al.*, No. 10 Original, Supreme Court of the United States.—In this action the State of Arizona is seeking a determination of its rights in and to the use of the waters of the Colorado River, as against such rights claimed by the defendants, under the Colorado River Compact, the Boulder Canyon Project Act, and the California Limitation Act. Trial of the case before Special Master Simon H. Rifkind continued for four sessions being held, in July 1957, in August 1957, in January 1958, and in May 1958.

5. *George H. Pashley, et ux. v. United States*.—This action was filed in the Court of Claims in March 1955 for \$200,000 in damages for the alleged flooding of a sodium sulphate deposit below the O'S

Dam as a result of the construction and operation of that dam by the Bureau of Reclamation on the Columbia Basin project. On November 4, 1957, the Court rendered its decision (156 F. Supp.) holding that the erection of the dam had caused the flooding, and awarded plaintiffs \$2,500 damages.

J. W. Wheeler Co. v. Jean Lee Knight Tripp, Defendant and Third Party Plaintiff, and United States, Third Party Defendant.—Defendant's complaint against the additional defendant United States was filed in the United States District Court, Western District of Washington, Northern Division, Seattle, Wash., in May 1958 for the purpose of having a recordable contract on certain Columbia Basin project land owned by plaintiff declared a nullity because of alleged failure of the United States to plat it as a farm unit and construct irrigation facilities to serve it under the recordable contract between the United States and the original landowner entered into in April 1946. The issues between the defendant and the United States have not been joined.

United States v. Crow Tribal Lands, et al., Civil No. 1825.—The case was filed in February 1956 in the United States District Court, District of Montana. It is an action to condemn the Crow Indian tribal interests in the site of the Bureau of Reclamation's Yellowtail Dam and Reservoir. In the opinion of January 8, 1957 (152 F. Supp. 861), the Court denied defendants' motion to dismiss, and affirmed the Government's right to condemn tribal lands. A pretrial conference was held December 16, 1957.

In an opinion dated May 15, 1958, the Court reaffirmed the Government's right to condemn tribal lands, but held that under the Crow Tribal Land Act of 1920 the tribe was entitled to be compensated for the power values; that the question of compensation should be referred to commissioners; and that the question of navigability should be decided by the Court without a jury. The Court set the hearing on the navigability of the Big Horn River for August 11, 1958.

Merle H. Johnson, Administrator of the Estate of Stanley Matt Johnson, Deceased v. United States, Civil No. 49, and *Merle H. Johnson v. United States*, Civil No. 54.—These cases, arising under the Federal Tort Claims Act, were filed in the United States District Court for the District of Montana in September of 1956 for \$100,000 and \$17,680, respectively, in damages occasioned by the electrocution of a 4-year-old boy who had climbed over a Bureau electrical substation fence. In an opinion dated May 1, 1958, the Court denied plaintiff's claims, holding that the United States had exercised due care under the circumstances.

Ronald Miller et al. v. Robert W. Jennings, et al., United States Court of Appeals for the 5th Circuit (No. 16135).—The history of

this case appears in the 1957 Annual Report of the Secretary, p. 89. A petition for a writ of certiorari was denied by the United States Supreme Court on October 14, 1957.

10. *Ivanhoe Irrigation District et al. v. McCracken et al.; Related Cases.*—(Nos. 122, 123, 124, and 125, October term 1957, United States Supreme Court).

On June 23, 1958, Mr. Justice Clark delivered the opinion of the Supreme Court of the United States in the above designated case reversing the judgments of the Supreme Court of California the (306 P. 2d 824 *et. seq.*). The decision was unanimous, Justice Frankfurter not participating. Involved was the validity of certain contracts entered into pursuant to the Federal reclamation laws between the United States and the Ivanhoe Irrigation District, the Modoc Irrigation District, and the Santa Barbara County Water Agency severally. The contracts in question were submitted by the districts and the agency to their respective county Superior Courts in California for statutory confirmation proceedings, commencing as early as October 31, 1949. Appeals from the rulings of the several Superior Courts were consolidated in the California Supreme Court, and a 4 to 3 decision was rendered therein January 24, 1957. The holding of the California Supreme Court was that certain provisions of each of the three contracts were invalid, namely: those limiting the right to the use of water to 160 acres of irrigable land in a single ownership, and those providing for the payment of an annual charge for water service pursuant to Section 9 of the Reclamation Project Act of 1939.

The grounds upon which the California Supreme Court based its decision are taken from the construction placed upon that decision by the United States Supreme Court. The decision below held that Section 8 of the Reclamation Act of 1902 required the application of California law to the contracts, and found the above-mentioned provisions of the contracts contrary thereto.

The districts and the agency were joined by the State of California in an appeal to the United States Supreme Court, which court postponed the jurisdictional question of consideration on the merits (308 U. S. 803 (1957)). The Solicitor General of the United States appeared as *amicus curiae* before the Court. In its decision, the United States Supreme Court determined that the decision complained of did not hold unconstitutional a Federal statute but rather misinterpreted a provision of Federal law. The Court also found it erroneous that the judgments did not rest on an adequate State ground. The appeals were disallowed, but certiorari was granted for consideration on the merits. The decision on the merits is that the contracts

controlled by Federal law and are valid against the objections e.

The United States Supreme Court made it clear that its decision not involve the question of title to or vested rights in unappropriated water. The Court decided that, among other things, the California court had misconstrued Section 8 of the 1902 Act as overriding provisions concerning the 160 acre limitation contained in Section 7 of that Act. On the constitutional question, the court pointed out that the project is a Federal subsidy and that the provisions under which the project is operated are entirely reasonable and do not deprive appellees of any rights to property or water. As to the provisions for payment of charges for water service, the court found that particularly in view of the Act of July 2, 1956 (70 Stat. 483) the contracts were not objectionable on the ground that they infer that the water users are not entitled to water rights beyond the 40-year term of the contract. The court also dismissed the objection that the contracts did not recite the total amount due for water supply facilities, particularly since no interest is charged. Based upon the same considerations of substance and the absence of an interest charge, together with the extended periods of payment on account of costs of water supply facilities, the court found it "altogether reasonable" to defer the question of passage of title to the works "to another day."

BONNEVILLE POWER ADMINISTRATION

William A. Pearl, *Administrator*

FINANCIAL RESULTS OF OPERATIONS

INSTALLED GENERATING CAPACITY for the Columbia River power system increased by 632,000 kilowatts during the fiscal year 1958. This increase resulted from the installation and placing in service of five 64,000 kilowatt generating units at the Chief Joseph project and four 78,000 kilowatt units at The Dalles project. The total installed capacity for the system at the end of the fiscal year 1958 was 5,334,000 kilowatts.

Gross revenues for 1958 for the Columbia River power system were \$66,729,110, an increase of only \$329,143, or over one-half of 1 per cent over the previous year. Gross revenues for 1958 fell about \$5,200,000 below the amount that had been estimated at the outset of the year. The principal reasons for this were the failure of contributors' loads to reach estimates because of the economic recession and an unusually mild winter, and the curtailment of both interruptible and firm power consumption by the large industries, principally aluminum, served directly by the Federal power system.

After provisions for all costs of operation, including maintenance interest and depreciation expenses and miscellaneous charges, the

TABLE I.—Columbia River power system—condensed summary of revenues and expenses—operating projects only

| | Fiscal year 1957 | Fiscal year 1958 | Total to July 30, 1958 |
|--|---------------------|---------------------|---------------------------|
| Operating revenues..... | \$66,399,967 | \$66,729,110 | \$595,937 |
| Expenses of operation, maintenance, etc..... | 16,163,379 | 18,275,384 | 159,447 |
| Provision for depreciation..... | 20,255,154 | 23,707,658 | 145,311 |
| Interest expense..... | 24,015,702 | 27,695,569 | 189,411 |
| Total deductions..... | 60,434,235 | 69,678,611 | 494,170 |
| Net revenues from operations..... | 5,965,732 | (2,949,501) | 101,767 |

icit for the year amounted to \$2,949,501. The net revenues for fiscal year 1957 were \$5,965,732.

Table I presents a combined statement of revenues and expenses to the system. The data are prepared from commercial cost accounts kept in accordance with the Federal Power Commission's system of accounts prescribed for electric utilities.

Summary of Revenue

Table II summarizes by customer categories the source of revenues for fiscal years to and including 1958. The aluminum industry accounted for 26.21 percent of the revenue dollar for fiscal year 1958, while industries other than aluminum accounted for 14.19 percent, making a total of 40.40 percent of the gross revenues for the year provided by industrial customers.

Sales to publicly owned utilities were 35.33 percent of the total and privately owned utilities 21.24 percent. Other operating revenues amounted to 3.03 percent.

Increased sales occurred in all categories except aluminum and private utilities. Sales to aluminum industries decreased \$2,534,165. Sales to other industries increased \$1,015,510 as compared with the previous year; sales to publicly owned utilities increased \$1,529,450, and sales to privately owned utilities decreased \$278,762.

Payment of Federal Investment

The gross Federal investment in the power portion of all the generating projects in operation and in related transmission facilities comprises the total of all funds appropriated and requisitioned for construction and operations, together with indirect items such as BPA expenditures and amounts transferred from other Federal agencies, plus interest at the rate of 2½ percent per annum on the repaid balance.

As of June 30, 1958, this investment amounted to \$1,937,409,749, shown in table IV. This includes accumulated interest in the amount of \$263,349,095. A summary of the interest accumulation is shown in table III.

With the exception of the amounts transferred to the continuing fund, all receipts from power sales and miscellaneous sources allocated to power are deposited in the Treasury to repay the Federal investment.

As of June 30, 1958, repayments total \$580,481,605, leaving an unpaid balance of \$1,356,928,144. Of the total repaid, \$330,513,610

TABLE II.—Revenue by class of customers through fiscal year 1958

| Class of customer | 1953 and prior | 1954 | 1955 | 1956 | 1957 | 1958 | Total to June 30, 1958 | 1958 percentage (dollar revenue) |
|---------------------------|----------------|--------------|--------------|--------------|--------------|--------------|------------------------|----------------------------------|
| Industry: | | | | | | | | |
| Aluminum | \$127,994,609 | \$15,944,356 | \$16,909,588 | \$20,098,110 | \$20,025,700 | \$17,491,535 | \$218,463,898 | 26.21 |
| Other ¹ | 34,256,315 | 5,417,177 | 6,821,850 | 8,186,874 | 8,451,336 | 9,466,846 | 72,600,398 | 14.19 |
| Publicly owned utilities | 65,825,672 | 14,882,997 | 17,601,135 | 19,505,231 | 22,044,831 | 23,574,281 | 163,434,147 | 35.33 |
| Privately owned utilities | 69,510,541 | 7,882,879 | 9,926,150 | 11,999,475 | 14,450,108 | 14,171,346 | 127,940,499 | 21.24 |
| Other operating revenue | 6,841,957 | 1,190,284 | 807,759 | 1,202,933 | 1,427,992 | 2,025,102 | 13,496,027 | 3.03 |
| Total operating revenue | 304,429,094 | 45,317,693 | 52,066,482 | 60,992,623 | 66,399,967 | 66,729,110 | 585,934,969 | 100.00 |

¹ Includes sales to Federal agencies.

presents payment of all current expenses since inception of the program. The remaining amount of \$249,967,995 is repayment on capital investment of \$1,606,896,139 as shown in table IV.

Summary of plant accounts as of June 30, 1958, is shown in table V.

Based on individual projects, the return of power capital investment has been as follows:

TABLE III.—*Columbia River power system—summary of interest on Federal investment as of June 30, 1958*

Interest during construction, to be returned during repayment period as part of the Federal investment:

| | |
|--------------------------------------|----------------|
| Bonneville Power Administration..... | \$7, 020, 753 |
| Bonneville Dam project..... | 2, 335, 609 |
| Columbia Basin project..... | 9, 687, 396 |
| Hungry Horse project..... | 4, 708, 542 |
| McNary Dam project..... | 19, 182, 533 |
| Albeni Falls project..... | 1, 029, 562 |
| Detroit-Big Cliff project..... | 2, 593, 654 |
| Lookout Point-Dexter project..... | 2, 880, 509 |
| Chief Joseph project..... | 11, 115, 076 |
| Chandler project..... | 164, 751 |
| The Dalles project..... | 13, 217, 097 |
| Subtotal..... | \$73, 935, 482 |

Interest charged to operations:

| | |
|--------------------------------------|----------------|
| Bonneville Power Administration..... | \$57, 724, 937 |
| Bonneville Dam project..... | 21, 705, 804 |
| Columbia Basin project..... | 60, 552, 416 |
| Hungry Horse project..... | 11, 168, 394 |
| McNary Dam project..... | 20, 670, 018 |
| Albeni Falls project..... | 2, 938, 703 |
| Detroit-Big Cliff project..... | 4, 615, 792 |
| Lookout Point-Dexter project..... | 3, 286, 500 |
| Chief Joseph project..... | 5, 476, 567 |
| Chandler project..... | 205, 253 |
| The Dalles project..... | 1, 069, 229 |
| Subtotal..... | 189, 413, 613 |
| Gross interest accumulation..... | 263, 349, 095 |

TABLE IV.—*Columbia River power system—summary of Federal investment in operating power projects and repayment as of June 30, 1958*

| | Gross investment | Repayments | Net investment |
|--|------------------|---------------|-----------------|
| Investment in current expenses: | | | |
| Operation, maintenance, etc. | \$141,099,997 | \$141,099,997 | ----- |
| Interest ¹ | 189,413,613 | 189,413,613 | ----- |
| Total current expenses | 330,513,610 | 330,513,610 | ----- |
| Investment in capital assets: | | | |
| Electric plant investment ² | 1,589,179,834 | 249,967,995 | \$1,339,201,839 |
| Unexpended appropriations | 17,716,305 | ----- | 17,716,305 |
| Total capital investment | 1,606,896,139 | 249,967,995 | 1,356,928,144 |
| Total Federal investment | 1,937,409,749 | 580,481,605 | 1,356,928,144 |

¹ The Columbia River power system does not receive appropriations for payment of interest, but includes in its accounts provisions for interest expense and returns receipts to the Treasury in repayment of such expenses.

² Includes interest during construction of \$73,935,482 which will be repaid to the Treasury as part of cost of electric plant.

TABLE V.—*Columbia River power system summary of plant accounts in operating projects as of June 30, 1958*

| Project | Total | Allocation | |
|--|---------------|--------------|---------------|
| | | Nonpower | Power |
| Bonneville Power Administration | \$443,133,054 | ----- | \$443,133,054 |
| Bonneville Dam project | 86,737,598 | \$27,238,476 | 59,499,122 |
| Columbia Basin project | 528,592,522 | 323,452,550 | 205,139,972 |
| Hungry Horse project | 106,354,857 | 19,451,732 | 86,903,125 |
| Albion Falls project | 31,438,720 | 290,725 | 31,148,000 |
| McNary Dam project | 305,308,958 | 26,448,621 | 278,860,337 |
| Detroit-Big Cliff project | 65,862,443 | 24,230,800 | 41,631,643 |
| Lookout Point-Dexter project | 93,057,887 | 51,486,784 | 41,571,103 |
| Chief Joseph project | 155,514,795 | 2,461,640 | 153,053,155 |
| Chandler project | 35,113,081 | 30,749,882 | 4,363,199 |
| The Dalles project | 239,536,362 | 21,515,386 | 218,020,976 |
| Total plant | 2,090,650,277 | 527,326,596 | 1,563,323,681 |
| Less combined reserve for depreciation | ----- | ----- | 132,597,437 |
| Total less reserve | ----- | ----- | 1,430,726,244 |

| Project | Power capital investment ¹ | Repaid as of June 30, 1958 | Percent repaid | Net power investment |
|---------------------------------------|---------------------------------------|----------------------------|----------------|----------------------|
| Bonneville Power Administration | \$465,857,813 | \$117,513,763 | 25.23 | \$348,344,050 |
| Bonneville Dam | 60,048,577 | 26,814,504 | 44.65 | 33,234,073 |
| Columbia Basin project | 207,650,846 | 65,383,789 | 31.49 | 142,267,057 |
| Hungry Horse | 87,805,800 | 7,516,802 | 8.56 | 80,288,998 |
| Albion Falls | 31,162,302 | 2,061,371 | 6.61 | 29,100,931 |
| McNary | 278,868,574 | 20,370,571 | 7.30 | 258,497,003 |
| Detroit-Big Cliff | 41,833,157 | 3,343,088 | 7.99 | 38,490,069 |
| Lookout Point-Dexter | 41,585,311 | 2,419,140 | 5.82 | 39,166,171 |
| Chief Joseph | 152,920,738 | 3,582,987 | 2.34 | 149,337,751 |
| Chandler | 4,342,608 | 269,995 | 6.22 | 4,072,613 |
| The Dalles | 217,104,108 | 691,985 | .32 | 216,412,123 |
| Total | 1,589,179,834 | 249,967,995 | 15.72 | 1,339,211,839 |

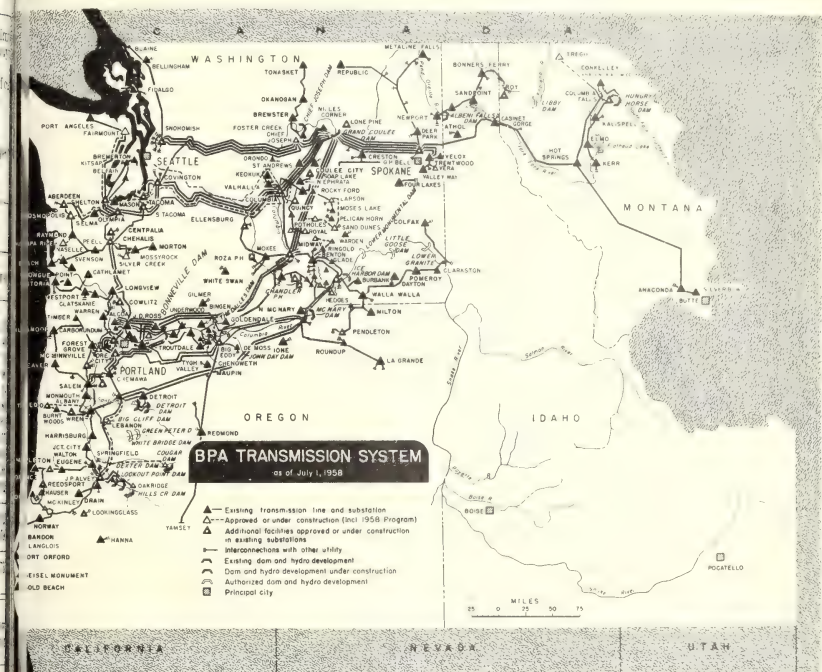
¹ Exclusive of unexpended funds in United States Treasury.

The data in this table are based on cost accounts maintained in accordance with the Federal Power Commission uniform system of accounts.

SUMMARY OF OPERATIONS

Energy Production

Over 30 billion kilowatt-hours of electric energy were generated by the 12 Federal plants for the Bonneville Power Administration during the fiscal year 1958. This was an increase of 0.7 percent over the 1957 fiscal year. The addition of five generating units at Chief Joseph and four units at The Dalles added 632,000 kilowatts to the system giving a total of 5,334,000 kilowatts nameplate rating as of the 30, 1958.

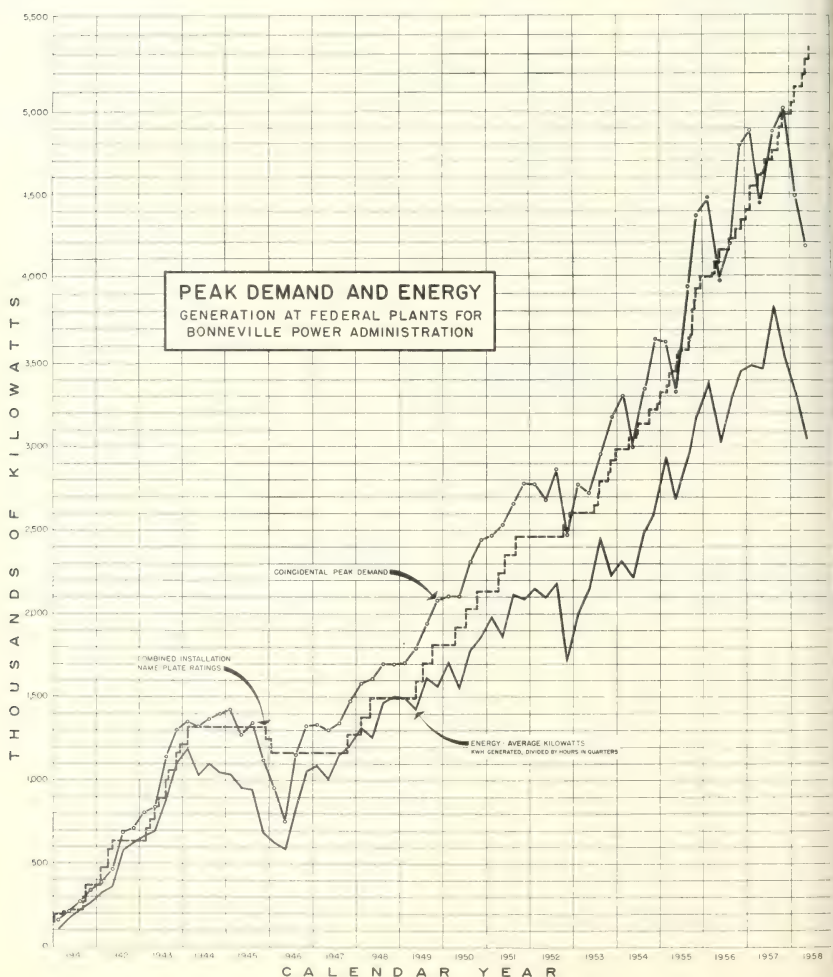
*New System Peak*

A new system peak was established during the 5-6 p. m. hour on November 21, 1957, before three units at Chief Joseph and two units at The Dalles were added to the system. Maximum coincident demand on the 12 Federal plants was 5,024,000 kilowatts, an increase of 2.8 percent over the previous year's maximum demand of 4,887,000 kilowatts which occurred on January 25, 1957. Energy produced at the Federal plants for the Administration is shown by years in table VI

and illustrated in the accompanying chart. Prepared on a quarterly basis, the chart shows the general trends of the Bonneville Power Administration's system-load growth.

Receipts and Deliveries

Bonneville Power Administration's transmission grid forms the backbone of the interconnected transmission system of public and private utilities in the Pacific Northwest. As a result, electric energy receipts and deliveries on Bonneville's transmission system cover many complex transactions in addition to receipts from Federal powerplants and deliveries by sales.



E VI.—Generation at Federal plants for the Bonneville Power Administration, fiscal years 1939–58

BY FISCAL YEARS

| Fiscal years ending June 30 | Generation (thousands of kilowatt- hours) | Maximum demand (kilowatts) | Load factor (percent) |
|-----------------------------|--|----------------------------------|-----------------------------|
| 1939 | 1,144,932 | 210,000 | |
| 1940 | 2,549,153 | 468,000 | 62.2 |
| 1941 | 5,618,436 | 841,000 | 76.3 |
| 1942 | 9,239,823 | 1,355,000 | 77.6 |
| 1943 | 9,051,573 | 1,427,000 | 72.4 |
| 1944 | 6,236,163 | 1,346,000 | 52.9 |
| 1945 | 8,753,737 | 1,335,000 | 74.9 |
| 1946 | 10,885,907 | 1,610,000 | 77.0 |
| 1947 | 12,925,788 | 1,797,000 | 82.1 |
| 1948 | 14,140,834 | 2,106,000 | 76.7 |
| 1949 | 16,472,384 | 2,535,000 | 74.2 |
| 1950 | 18,555,401 | 2,784,000 | 75.9 |
| 1951 | 17,633,232 | 2,867,000 | 70.2 |
| 1952 | 20,195,833 | 3,301,000 | 69.8 |
| 1953 | 23,253,186 | 3,651,000 | 72.7 |
| 1954 | 27,599,380 | 4,479,000 | 70.1 |
| 1955 | 29,984,219 | 4,887,000 | 70.0 |
| 1956 | 30,201,078 | 5,024,000 | 68.6 |
| Total | 264,441,059 | 5,024,000 | |

BY PLANTS

| | Generation ¹ (millions of kilowatt-hours) | | Date in service ² | Operating agency |
|----------------------------|---|--------------------------|---------------------------------|------------------|
| | Fiscal year 1958 | Total to July 1, 1958 | | |
| Beaver Falls | 217 | 727 | Mar. 25, 1955 | Army Engineers. |
| Bluff | 95 | 402 | June 12, 1954 | Do. |
| Bonneville | 3,784 | 63,949 | June 6, 1938 | Do. |
| Caldwell | 88 | 180 | Feb. 13, 1956 | USBR. |
| Joseph ³ | 5,872 | 12,107 | Aug. 20, 1955 | Army Engineers. |
| Louis ⁴ | 355 | 1,999 | July 1, 1953 | Do. |
| Long | 77 | 245 | May 19, 1955 | Do. |
| Grand Coulee ³ | 11,784 | 155,826 | Sept. 28, 1941 | USBR. |
| Larry Horse | 785 | 4,649 | Oct. 29, 1952 | Do. |
| Lookout Point ⁴ | 317 | 1,324 | Dec. 16, 1954 | Army Engineers. |
| Mary | 5,602 | 21,793 | Nov. 6, 1953 | Do. |
| Tualley | 1,225 | 1,240 | May 13, 1957 | Do. |
| Total | 30,201 | 264,441 | | |

¹ Includes energy generated in testing new generating units.² Date of commercial operations.³ Includes energy transferred for Bureau of Reclamation.⁴ Includes energy for condenser power at Detroit and Lookout Point.

The integrated transmission grid makes possible the fullest utilization of power facilities in the area through diversity in peaking and water capabilities and diversity of system-load conditions. Substantial quantities of energy are received and delivered as transfers from other utilities.

Power generated at non-Federal projects such as Rock Island, Pelton, Box Canyon, and energy from the Inter-Company pool, was transmitted under firm contracts during fiscal year 1958 over the Administration's system and delivered either to the particular system owning the plant or to a customer of the system. The Administra-

tion has entered into contracts with 10 utilities for wheeling of power from the Priest Rapids project over the Administration's system, with three utilities for wheeling of power from the Rocky River project when these projects commence operation.

During periods when it was necessary for the Administration to curtail its interruptible power deliveries to industries, power secured from the industries from generation at non-Federal plants was transmitted over the Administration's system to supply the particular industrial loads.

Transactions also involve storage by the Administration in non-Federal reservoirs as well as storage by non-Federal utilities in Grand Coulee Reservoir. Disposition of energy includes delivery from storage in Grand Coulee or to storage in other reservoirs, energy transfers for the Bureau of Reclamation from Grand Coulee to Chief Joseph, energy used by the Administration, and energy losses in transmission and transformation.

Table VII, electric energy account, summarizes energy receipts and deliveries for fiscal year 1958.

TABLE VII.—*Electric energy account for fiscal year 1958*

Energy received (millions of kilowatt-hours) :

| | |
|---|--------|
| Energy generated at Federal plants for BPA ¹ ----- | 30,000 |
| Power interchanged in----- | 3,000 |
| Total received----- | 33,000 |

Energy delivered (millions of kilowatt-hours) :

| | |
|---|-----------|
| Sales----- | 28,400 |
| Power interchanged out----- | 3,000 |
| Used by Administration----- | 0 |
| Total delivered----- | 32,400 |
| Energy losses in transmission and transformation----- | 1,000 |
| Losses as percent of total energy received—percent----- | |
| Maximum demand on generating plants (kilowatts), Nov. 21, 1957, 5-6 p. m., Pacific standard time----- | 5,024,000 |
| Load factor, total generated for BPA, percent----- | 68 |

¹ For detail by plants, see table VI.

Sale of 28 Billion Kilowatt-Hours

Energy sales to customers of the Bonneville Power Administration totaled 28.4 billion kilowatt-hours during the fiscal year 1958, an increase of 0.5 percent over 1957.

Energy sales to industrial customers decreased while sales to Federal agencies and to other utilities increased over the 1957 fiscal year.

tabulation below shows the changes in sales by classes of consumers.

BPA energy sales—Fiscal year 1958

| | Millions of kilowatt- hours | Percent change from 1957 |
|--------------------------------|-----------------------------------|--------------------------------|
| Hydro plants..... | 8,717 | -14 |
| Industries..... | 1,544 | -5 |
| Agencies..... | 2,509 | +29 |
| Total ultimate consumers..... | 12,770 | -7 |
| Publicly owned utilities..... | 8,898 | +12 |
| Privately owned utilities..... | 6,697 | +2 |
| Total to other utilities..... | 15,595 | +7 |
| Total BPA..... | 28,365 | +0.5 |

Firm energy sales to industries increased 1 percent in fiscal 1958 over fiscal 1957 and interruptible sales decreased 45 percent, for an overall decrease to industrial customers of 12 percent. Utilities with their own generation had unusually good water conditions last winter, resulting in decreased need for dump energy from BPA. There was a decrease of 8 percent in dump sales during fiscal year 1958 as compared to a 30 percent increase in 1957 over 1956.

During the September–December 1957 months power resources were inadequate, and required a reduction in deliveries of interruptible energy to industrial customers in order to meet the Administration's firm power commitments and requirements of higher priority consumers. During these 4 months the interruptible energy sales were 48 percent of the energy the customers would have purchased had total requirements been available. In the last 6 months of fiscal year 1958, interruptible energy was available, but because of unfavorable market conditions industrial customers purchased only 600,000 kilowatt-hours of interruptible energy as compared with 1 billion kilowatt-hours during January–June 1957.

The 2.9 billion kilowatt-hours of interruptible energy sales include 600,000 kilowatt-hours and \$1,039,712 provisional sales to 10 industrial customers. These provisional sales were made possible by generation from storage releases beyond normal operating drawdown of Hungry Horse and Grand Coulee Reservoirs.

Composite Average Rate of 2.36 Mills

The Administration has sold 247.0 billion kilowatt-hours of electric energy at a composite rate of 2.36 mills per kilowatt-hour during the 20 years of operation ended June 30, 1958. Sales to publicly owned utilities for the 20 years were 58.8 billion kilowatt-hours at an average

of 2.78 mills. Privately owned utilities received 56.3 billion kilowatt-hours at an average of 2.27 mills, and ultimate consumers such as industries and Federal establishments received 131.9 billion kilowatt-hours at 2.21 mills.

Power sales to aluminum plants were 103.9 billion kilowatt-hours at an average of 2.10 mills. These plants characteristically take power at very high load factors, approaching 100 percent, which results in the exceptionally low average cost on the Administration's C and D rate schedules. Sales to industries other than aluminum, including sales to Federal agencies, were 27.9 billion kilowatt-hours at an average of 2.59 mills.

Energy sales by classes of customers are shown in table VIII.

TABLE VIII.—*Electric energy sales by class of customer, fiscal years 1939-1958*
[Millions of kilowatt-hours]

| Fiscal years ending June 30 | Industry | | Publicly owned utilities | Privately owned utilities | Total |
|-----------------------------|----------------------|-------------------------------|--------------------------|---------------------------|----------------------|
| | Aluminum | Other industries ¹ | | | |
| 1939-41 | 523 | 5 | 35 | 537 | |
| 1942 | 1,845 | 79 | 143 | 358 | |
| 1943 | 3,589 | 507 | 435 | 739 | |
| 1944 | 5,454 | 1,022 | 728 | 1,467 | |
| 1945 | 4,667 | 965 | 824 | 2,057 | |
| 1946 | 2,492 | 800 | 636 | 1,903 | |
| 1947 | 4,212 | 627 | 1,045 | 2,378 | |
| 1948 | 4,902 | 647 | 1,561 | 3,181 | |
| 1949 | 5,666 | 881 | 2,081 | 3,342 | |
| 1950 | 5,863 | 1,024 | 2,840 | 3,312 | |
| 1951 | 6,545 | 1,538 | 3,414 | 3,579 | |
| 1952 | 6,472 | 1,943 | 4,803 | 3,794 | |
| 1953 | 6,547 | 1,947 | 5,110 | 2,791 | |
| 1954 | ² 7,862 | 2,253 | 5,127 | 3,531 | |
| 1955 | ² 8,352 | 2,624 | 6,274 | 4,580 | |
| 1956 | 10,141 | 3,422 | 6,909 | 5,505 | |
| 1957 | ² 10,096 | ² 3,581 | 7,970 | 6,565 | |
| 1958 | ² 8,717 | ² 4,053 | 8,898 | 6,697 | |
| Total to July 1, 1958 | ² 103,945 | ² 27,918 | 58,833 | 56,316 | ² 241,992 |

¹ Includes Federal agencies.

² Includes provisional and replaceable sales to industries:

| | Aluminum | Other industries |
|--------------|-------------|------------------|
| Fiscal year: | | |
| 1954 | 28,355 mwh | |
| 1955 | 22,956 mwh | |
| 1957 | 323,509 mwh | 27,817 mwh. |
| 1958 | 481,522 mwh | 32,194 mwh. |

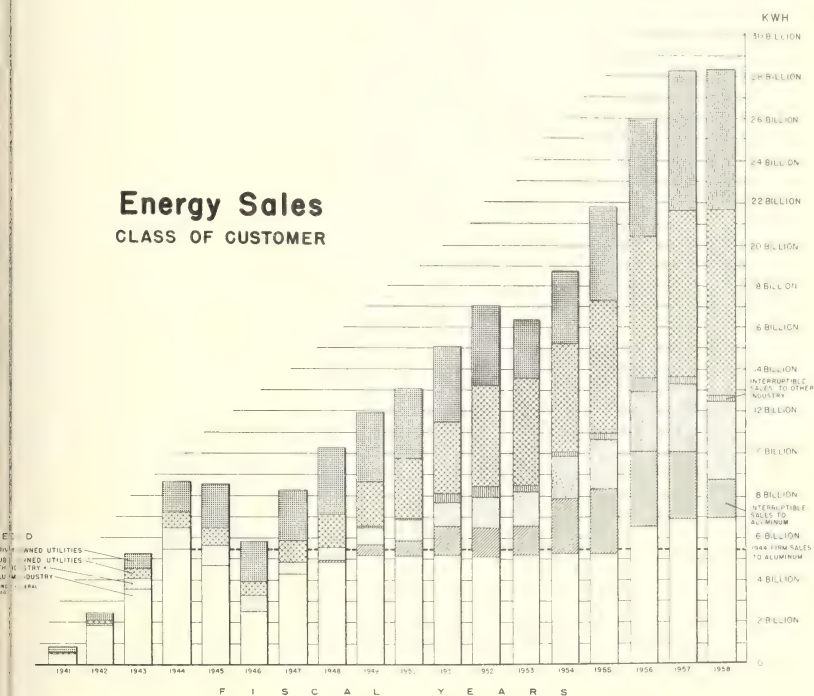
Rate Schedules

During the last fiscal year almost three-quarters of the energy sales were made under the C-4 wholesale rate schedule at an average rate of 2.12 mills per kilowatt-hour. This is the kilowatt-year rate for firm power delivered anywhere from the transmission system, and is

used with special measured demand provisions for sales of interruptible power. Sales are generally made under this rate to industries operating at high load factor and to utilities having substantial generating facilities. Other sales were made principally under the rate schedule to utilities purchasing all or substantially all of their power requirements from the Administration. At-site power is sold on a kilowatt-year basis under the A-4 rate. Sales under the F-4 schedule were made to the utilities and industries requiring power at high load factor use, and under the H schedule for dump, exchange, or experimental purposes. A summary of energy sales for the fiscal year 1958 classified by rate schedules is shown in table IX.

Energy Sales

CLASS OF CUSTOMER



A special review of the Administration's rate structure by the Ford, Bacon & Davis Co. was completed during the 1956 fiscal year. Study of special phases of this report by the staff was continued during this last year.

A special study by the staff was continued during fiscal year 1958 of the Administration's entire present wholesale rate structure and development of a rate by which low-availability secondary energy in excess of that sold under present rates can be marketed.

TABLE IX.—*Electric energy sales by rate schedules during fiscal year 1958*

| Rate schedule | Energy (thousands of kilowatt- hours) | Revenue ¹ | Mileage kilometers |
|--|--|---------------------------|-----------------------|
| C-4: | | | |
| Industries | ² 11,588,157 | ² \$24,625,138 | |
| Utilities | 9,618,145 | 20,307,245 | |
| Subtotal | 21,206,302 | 44,932,383 | |
| F-4: | | | |
| Industries | 8,505 | 39,274 | |
| Utilities | 52,766 | 227,643 | |
| Subtotal | 61,271 | 266,917 | |
| A-4: | | | |
| Industries | 912,793 | 1,565,737 | |
| Utilities | 12,017 | 42,990 | |
| Subtotal | 924,810 | 1,608,727 | |
| E-4: Utilities ³ | 4,475,534 | 14,031,478 | |
| Experimental, H-3 and exchange: Industries and utilities | 1,696,662 | 4,241,654 | |
| Total | ² 28,364,579 | ² 65,081,159 | |

¹ These revenues from sale of electric energy differ from official accounting records in that billing items applicable to only fiscal year 1958 are included.

² Includes 513,716,000 kw.-h. and \$1,039,712 provisional sales.

³ Including Federal agency pumping loads.

Customers Served

The Administration was serving 114 customers at the end of fiscal year 1958. There were 75 publicly owned distributors of power, 11 industrial customers, 11 Federal agencies, and 9 privately owned utilities.

One aluminum plant took initial service, and service was discontinued to one irrigation district during the year.

Generation Added

Additions to the United States Columbia River power system during fiscal year 1958 have a nameplate rating of 632,000 kilowatts. Ten units with a total rating of 320,000 kilowatts were installed at Camanche, Iowa, leaving one unit to be installed for the completed project at Joseph leaving one unit to be installed for the completed project. The first four main units with a total rating of 312,000 kilowatts were installed at The Dalles project on the Columbia River. The Corps of Engineers is construction agency for both of these projects.

Projects Summarized

Projects existing, under construction, and authorized for construction by the Corps of Engineers and Bureau of Reclamation are shown in the following table:

Table X. The existing projects including units installed to date in projects under construction will provide 4,026,000 kilowatts of prime power when operated as a system. With completion of the projects under construction the prime capability will be 5,395,000 kilowatts and with completion of the authorized projects prime capability will be over 6,000,000 kilowatts.

Existing storage capacity usable for power in Federal reservoirs is 868,500 acre-feet. An additional 403,000 acre-feet will be provided by Cougar and Hills Creek on which construction is under way and 5,343,000 acre-feet would be provided by Libby and Green River projects which are authorized for construction.

All generation and storage capacity under Federal construction will be in service by June 1968 under the present schedule. Service contracts for the other authorized projects are not scheduled as no funds have been appropriated for their construction.

Non-Federal Additions

Non-Federal generating capacity in the area served by the Administration was increased in fiscal year 1958 by installation of the 20,000 kilowatt unit No. 7 at the Snoqualmie Falls plant of Puget Sound Power & Light Co. in July 1957. In addition, the Pelton project of Portland General Electric Co. containing three generating units with a total nameplate rating of 108,000 kilowatts was completed in April 1958. Future additions under construction or licensed for construction by non-Federal utilities in this area are shown in table XI. These additions represent an increase of slightly more than 50,000 kilowatts of nameplate rating over projects in a comparable status one year previously.

Northwest Power Pool

Generation by the principal electric utility system of the Pacific Northwest during the fiscal year 1958 is shown in table XII. All utilities listed are members of the Northwest power pool with the exceptions of the Chelan County and Pend Oreille County Public Utility Districts. These two utilities are included because they provided substantial amounts of generation to the pool. The Utah Power & Light Co. and the British Columbia Electric Co. are members of the pool but are not included as their major service areas are outside the region.

TABLE X.—U. S. Columbia River power system—General specifications—Projects existing, under construction and authorized—Installations and capabilities correspond to a coordinated system operation, July 29, 1958

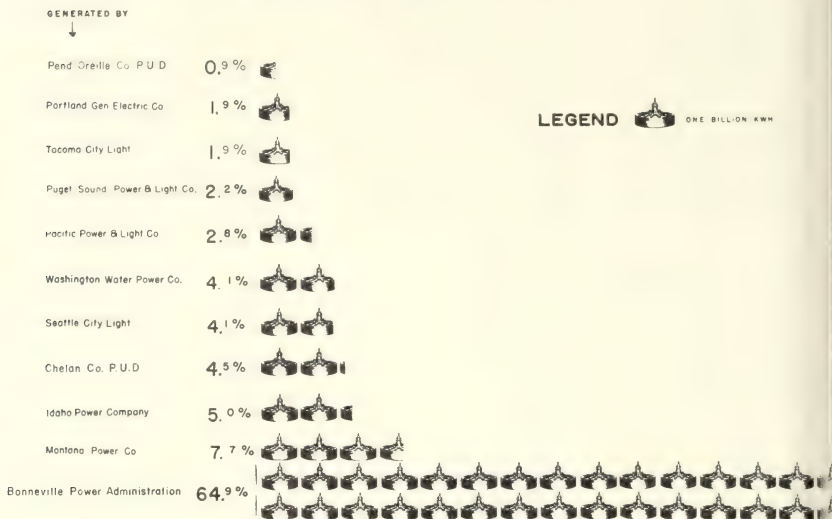
| Project | Location | Stream | Plant installations | | Nominal prime power (kilowatts) ² | Pool elevation (feet) | Usable storage (acre-feet) ⁴ | Average head (feet) | Date in service | | Principal purpose ⁵ |
|---------------------|--------------------|-------------------------|---------------------|---|--|-----------------------|---|---------------------|-----------------|----------------|--------------------------------|
| | | | Num-ber of units | Total capacity (kilowatts) ¹ | | | | | Initial unit | Last unit | |
| Existing: | | | | | | | | | | | |
| Bonneville | Washington-Oregon. | Columbia | 10 | 518, 400 | 466, 000 | 74 | Pondage | 58 | June 1938 | December 1943 | P. N. |
| Grand Coulee | Washington | do | 18 | 1, 944, 000 | 1, 552, 000 | 1, 288 | 5, 072, 000 | 315 | September 1941 | September 1951 | P. I. FC, N. |
| Hungry Horse | Montana | South Fork Flathead. | 4 | 285, 000 | 186, 000 | 3, 560 | 2, 982, 000 | 376 | October 1952 | July 1953 | P. I. FC, N. |
| Detroit | Oregon | North Santiam | 2 | 100, 000 | 39, 000 | 1, 563. 5 | 323, 000 | 285 | July 1953 | October 1953 | P. I. FC, N. |
| McNary | Washington-Oregon. | Columbia | 14 | 980, 000 | 527, 000 | 340 | Pondage | 75 | November 1953 | February 1957 | P. I. N. |
| Big Cliff | Oregon | North Santiam | 1 | 18, 000 | 11, 000 | 1, 206 | Pondage | 91 | June 1954 | June 1954 | P. Rereg. |
| Lookout Point | do | Middle Fork Willamette. | 3 | 120, 000 | 34, 000 | 926 | 336, 500 | 185 | December 1954 | April 1955 | P. I. FC, N. |
| Albeni Falls | Idaho | Pend Oreille | 3 | 42, 600 | 21, 000 | 2, 062. 5 | 1, 155, 000 | 18 | March 1955 | August 1955 | P. FC, N. |
| Dexter | Oregon | Middle Fork Willamette. | 1 | 15, 000 | 11, 000 | 695 | Pondage | 53 | May 1955 | May 1955 | P. Rereg. |
| Chief Joseph | Washington | Columbia | 15 | 960, 000 | 856, 000 | 946 | Pondage | 177 | August 1955 | June 1958 | P. I. |
| Chandler | do | Yakima | 2 | 12, 000 | 11, 000 | 618. 5 | 0 | 118 | February 1956 | February 1956 | P. I. |
| The Dalles | Washington-Oregon. | Columbia | 6 | 339, 000 | 312, 000 | 160 | Pondage | 86 | May 1957 | May 1958 | P. N. |
| | | | 5, 334, 000 | | 4, 026, 000 | | | 9, 868, 500 | | | |
| Under construction: | | | | | | | | | | | |
| Chief Joseph. | Washington. | do | 1 | 64, 000 | 0 | 946 | Pondage | 177 | November 1958 | November 1958 | P. I. |
| The Dalles. | Washington-Oregon. | do | 10 | 780, 000 | 362, 000 | 160 | Pondage | 86 | August 1958 | November 1960 | P. N. |
| Roza. | Washington. | Yakima | 1 | 11, 250 | 6, 000 | 1, 220. 6 | Pondage | 140 | do | August 1958 | P. I. |
| Cougar | Oregon | South Fork McKenzie. | 2 | 25, 000 | 17, 000 | 1, 690 | 154, 000 | 350 | November 1961 | November 1961 | P. I. FC, N. |
| Hills Creek | do | Middle Fork Willamette. | 2 | 30, 000 | 16, 000 | 1, 543 | 249, 000 | 210 | do | do | P. I. FC, N. |
| Ice Harbor | Washington. | Snake | 3 | 270, 000 | 171, 000 | 440 | Pondage | 97 | December 1961 | December 1961 | P. I. N. |
| John Day | Washington-Oregon. | Columbia | 12 | 1, 304, 400 | 737, 000 | 265 | Pondage | 104 | October 1966 | June 1968 | P. I. FC, N. |

| Lower Monumental | Washington | Snake | 3 | 270,000 | 169,000 | 533 | Pondage | 92 | P, I, N. |
|---------------------|------------|----------------|---|-----------|-----------|-----|------------|-----|---------------|
| Little Goose | do | do | 3 | 270,000 | 180,000 | 633 | Pondage | 99 | P, N. |
| Lower Granite | do | do | 3 | 300,000 | 184,000 | 735 | Pondage | 100 | P, N. |
| Green Peter | Oregon | Middle Santiam | 2 | 81,000 | 22,000 | 984 | 333,000 | 250 | P, I, F.C. N. |
| White Bridge | do | do | 1 | 15,000 | 9,000 | 670 | Pondage | 90 | P, Rereg. |
| Total, 23 projects. | | | | 1,452,000 | 821,000 | | 5,343,000 | | |
| | | | | | 3-31,000 | | | | |
| | | | | 9,270,650 | 6,185,000 | | 15,614,500 | | |

¹ Nameplate rating.
² Average capability in a coordinated system during an 8-month storage release period (September 1936 through April 1937).
³ Pumping requirements of 31,000 kw. represents the average power necessary to supply that part of irrigation water at Grand Coulee during the storage release period for 600,000 acres of the Columbia Basin project.
⁴ Storage usable for power production.
⁵ P—Power; I—Irrigation; F.C.—Flood Control; N—Navigation; PS—Power Storage; Rereg.—Reregulating Reservoir.

Power Generated BY THE PRINCIPAL ELECTRIC UTILITIES OF THE PACIFIC NORTHWEST

YEAR ENDED JUNE 30, 1958



TOTAL 46.5 BILLION KWH

SOURCE WEEKLY OPERATING REPORTS OF N.W. POWER POOL

THE ABOVE UTILITIES ARE MEMBERS OF THE NORTHWEST POWER POOL EXCEPT FOR CHELAN CO. AND PEND OREILLE PUBLIC UTILITY DISTRICTS. UTAH POWER & LIGHT CO. AND BRITISH COLUMBIA ELECTRIC CO. ARE ALSO POOL MEMBERS BUT ARE NOT INCLUDED IN THIS CHART BECAUSE THEIR MAJOR SERVICE AREAS LIE OUTSIDE THE PACIFIC NORTHWEST REGION.

Northwest Power Pool

OPERATIONS YEAR ENDING JUNE 30, 1958

BPA SUPPLIED 76% OF NET ENERGY REQUIREMENTS OF POWER POOL UTILITIES

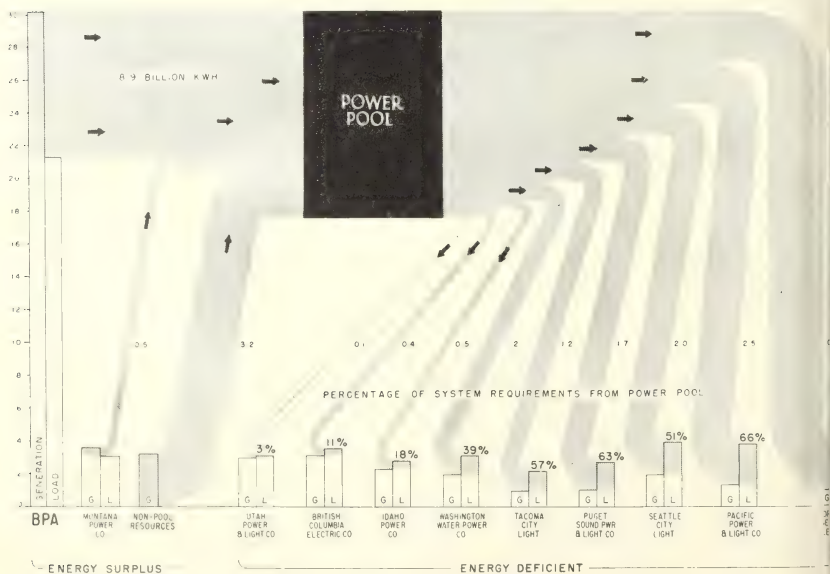


TABLE XI.—*Non-Federal utilities generator installation schedule, August 12, 1958*

| Utility and plant | Stream | Unit No. | Nameplate rating (thousands of kw.) | Date in service |
|---|-----------------|----------------|-------------------------------------|-----------------|
| Pacific Power & Light Co.: Terwin (addition) | Lewis River | 3 | 45 | September 1958. |
| Swift No. 1 | do | 1, 2, and 3 | 204 | December 1958. |
| Grand General Electric Co.: North Fork | Clackamas River | 1 | 19.2 | November 1958. |
| Bull Run | Bull Run River | 2 | 19.2 | December 1958. |
| Graday (addition) | Clackamas River | 6 | (1) 19.2 | November 1958. |
| Itz County PUD: Swift No. 2 | Lewis River | 1 and 2 | 70 | Do. |
| of Seattle: Diablo (reconstruction) | Skagit River | 1 and 2 | (2) | Do. |
| orge (reconstruction) | do | | (3) | December 1959 |
| of Eugene: Leaver Marsh | McKenzie River | 1 and 2 | 30 | July 1959. |
| Itz County PUD: Priest Rapids | Columbia River | 1, 2, 3, and 4 | 4 315.4 | September 1959. |
| | | 5 | 4 78.85 | October 1959. |
| | | 6 | 4 78.85 | December 1959. |
| | | 7 | 4 78.85 | March 1960. |
| | | 8 | 4 78.85 | April 1960. |
| | | 9 | 78.85 | July 1960. |
| | | 10 | 78.85 | September 1960. |
| Wanapum | do | 1 and 2 | 150 | May 1964. |
| | | 3 and 4 | 150 | June 1964. |
| | | 5 and 6 | 150 | July 1964. |
| | | 7 and 8 | 150 | August 1964. |
| Pacific Sound Power & Light Co.: Upper Baker | Baker River | 1 and 2 | 85 | September 1959. |
| Lower Baker (addition) | do | 3 | 57.6 | September 1960 |
| Wilton Water Power Co.: Coxon Rapids | Clark Fork | 1 | 84 | September 1959 |
| | | 2 | 84 | December 1959. |
| | | 3 | 84 | March 1960. |
| | | 4 | 84 | June 1960. |
| Itz County PUD: Rocky Reach | Columbia River | 1 | 101.65 | July 1961. |
| | | 2 | 101.65 | August 1961. |
| | | 3 | 101.65 | September 1961. |
| | | 4 | 101.65 | November 1961. |
| | | 5 | 101.65 | January 1962. |
| | | 6 | 101.65 | March 1962. |
| | | 7 | 101.65 | May 1962. |
| of Tacoma: Dayfield | Cowlitz River | 1 | 40 | September 1962. |
| | | 2 | 40 | December 1962. |
| | | 3 | 40 | March 1963. |
| | | 4 | 40 | June 1963. |
| Wossyrock | do | 1 | 75 | April 1965. |
| | | 2 | 75 | July 1965. |
| | | 3 | 75 | October 1965. |
| | | 4 | 75 | December 1965. |

Additional water for 55 mw-mo. of added energy.
 Construction of the turbines will increase peaking capability by 25,000 kilowatts.
 Construction of diversion dam will increase gross head by 100 feet and peaking capability by 57,000 kwatts.
 Headwater elevation for first year of operation will reduce net head to about 56 percent of full head
 will result in a reduction in capability to about 47,000 kilowatts per unit.

A total of 64.9 percent of the energy generated by the major utilities of the region was produced by the United States Columbia River power system. In addition to power requirements of utilities and industries served through the Administration's transmission system, 8.9 billion kilowatt-hours of energy were provided to other utilities for meeting their requirements.

TABLE XII.—*Generation by the principal electric utility systems of the Pacific Northwest, fiscal year 1958*¹

| Utilities | Kilowatt-hours (billion) | Percent of total generation |
|--|-----------------------------|-----------------------------------|
| Publicly owned: | | |
| U. S. Columbia River power system..... | 30.2 | |
| Chelan County PUD..... | 2.1 | |
| Seattle City Light..... | 1.9 | |
| Tacoma City Light..... | .9 | |
| Pend Oreille County PUD..... | .4 | |
| Total publicly owned..... | 35.5 | |
| Privately owned: | | |
| Montana Power Co..... | 3.6 | |
| Idaho Power Co..... | 2.3 | |
| Washington Water Power Co..... | 1.9 | |
| Pacific Power & Light Co..... | 1.3 | |
| Puget Sound Power & Light Co..... | 1.0 | |
| Portland General Electric Co..... | .9 | |
| Total privately owned..... | 11.0 | |
| Total generation..... | 46.5 | |

¹ Generation shown is for members of the Northwest Power Pool plus Chelan County and Pend Oreille County Public Utility Districts. Utah Power & Light Co. and British Columbia Electric Co. whose members of the Power Pool are not included because their service areas lie outside the Pacific Northwest region.

NOTE.—Shown as tabulation and chart in Annual Report. (Table XII and Figure 9 in 1957 Report.)

Transmission System Additions

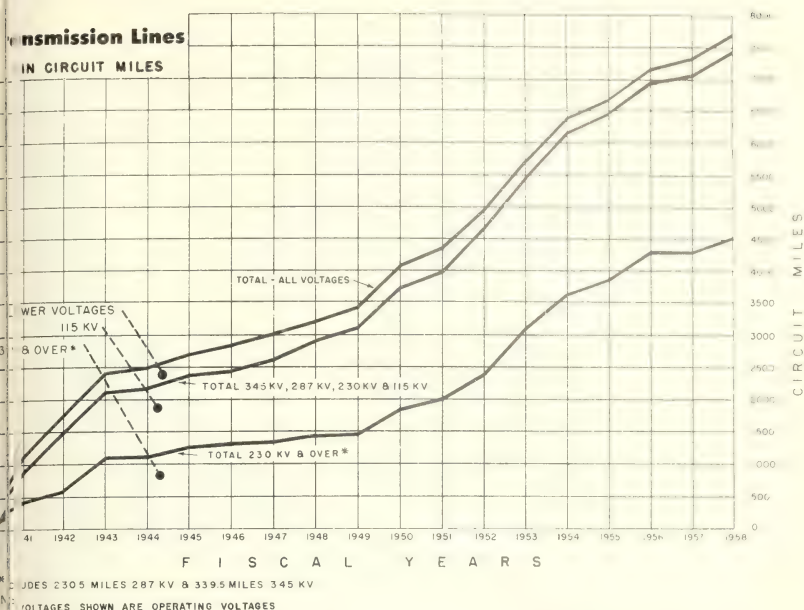
Bonneville Power Administration grid was increased during fiscal year to 7,680 circuit miles of transmission line and 186 substations with a transformer capacity of 12,708,248 kilovolt-ampere.

Transmission line mileage was increased by 362 circuit miles. The increase included 165 miles of 345,000-volt, 56 miles of 230,000-volt, 134 miles of 115,000-volt, and 7 miles of lesser voltage.

Ten new substations ranging in size from 3,000 to 270,000 kilovolt-amperes were energized, five were retired and two were sold. System transformer capacity was increased by 1,924,333 kilovolt-amperes, or 18 percent. This included installation of 1,820,333 kilovolt-amperes of additional transformation at 25 substations and 104,000 kilovolt-amperes by addition of forced cooling equipment at two substations.

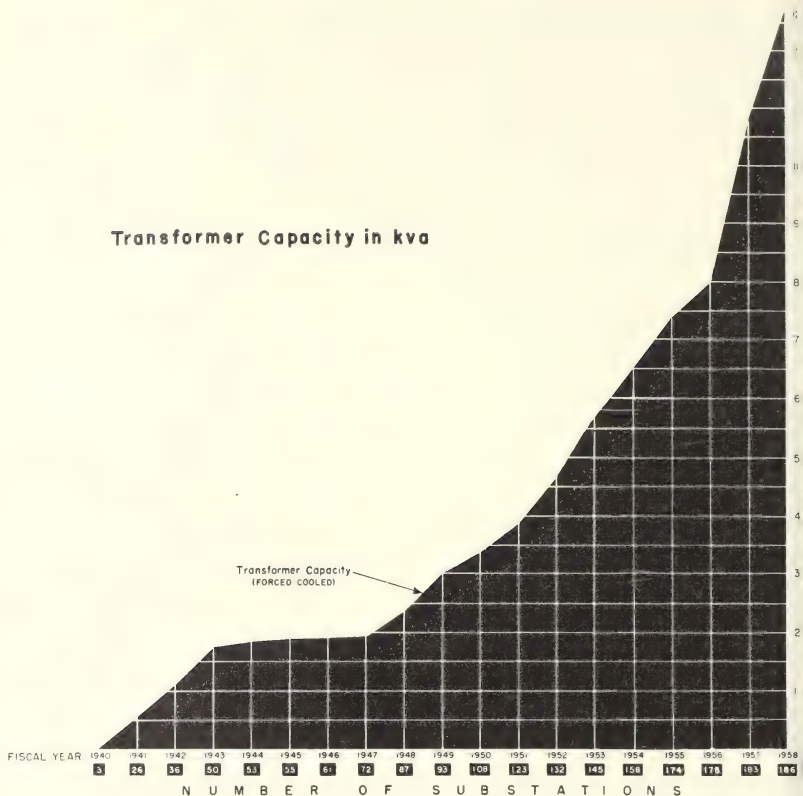
Construction Program

Major additions completed during the year included a 345,000-volt transmission line between Chief Joseph Dam and Covington including autotransformers at each terminal to augment the power supply to the Seattle and other Puget Sound areas. Other major additions completed included a 230,000-volt line between Big Eddy (The Dalles Dam) and Chemawa to reinforce the power supply into the Willamette Valley; a 230,000-volt Alvey-Reston-Fairview line to increase the



thern Oregon coastal area power supply; two 115,000-volt lines from Big Eddy to Chenoweth and Harvey substations to serve the Harvey Machine Co.'s aluminum production load and to improve service to the customers in Wasco County, Oreg., and Klickitat County, Wash.; a 230,000-volt line from Round Butte to Redmond to interconnect the Portland General Electric Co.'s Pelton generation with the BPA grid and to provide wheeling to the company's Portland office center; a 115,000-volt line from Big Eddy to the DeMoss 15,000-volt-ampere substation; and a 250,000 kva, 230/115-kilovolt transformer bank at the Franklin substation to increase the power capacity in the Lower Columbia Basin area.

A number of important grid additions were under construction at the beginning of the 1959 fiscal year. These include the 115,000-volt Ton-Fairmount line and 83,000 kilovolt-ampere Fairmount substation to meet the increased power load growth of the northern Olympic Peninsula area; a second 115,000-volt line between Olympia and Aberdeen to serve the increased load demand in the Grays Harbor area; a second 230,000-volt line between Santiam and Alvey substations to augment the power supply in southwestern Oregon; a 6,000-volt Columbia Falls-Trego line and a 6,000-kilovolt Trego substation to serve the power load growth in northwestern Montana; and a 250,000 kilovolt-ampere substation at Potholes, Wash., on the May-Coulee line No. 1 to supplement the power supply in the Columbia Basin area.



* INCLUDES 2,800,000 KVA OF AUTOTRANSFORMERS OPERATED AS PART OF TRANSMISSION LINES

New construction starts scheduled for fiscal year 1959 include a second 115,000-volt line from Albany to Toledo, Oreg., to bolster power supply in the Toledo area; a 230,000-volt line between Columbia, connected directly to Grand Coulee-Columbia line No. 3; a 230,000-volt line from Covington substation to bring Grand Coulee generation directly to the Puget Sound area; a 230,000-volt line constructed for 345,000-kva operation, from Chelan County Public Utility District's Rocky Mountain hydroelectric project to Maple Valley to bring the output of the project to western Washington; and another 230,000-volt line from The Dalles Dam to Big Eddy to integrate the additional generation into the system.

SOUTHWESTERN POWER ADMINISTRATION

Douglas G. Wright, *Administrator*

FOR THE FISCAL YEAR 1958, Southwestern Power Administration received appropriations and transfers amounting to \$1,022,731 for its operation and maintenance program and \$1,480,000 for new construction. Additional funds in the amount of \$469,696 remained available for completion of the Administration's previously approved construction program. Authorization by the Congress made available \$5,000,000 out of receipts to cover all costs in connection with the purchase of power and energy and the rental of transmission facilities.

POWER RESOURCES

The installed generating capacity and capability in the hydroelectric and steam electric plants in the integrated system as of June 30, 1958, is shown in the following table.

| Project or plant | River basin | Installed capacity | Capability (June 30, 1958) |
|--|-----------------------|--------------------|----------------------------|
| | | <i>Kilowatts</i> | <i>Kilowatts</i> |
| Hydroelectric: | | | |
| Interconnected system: | | | |
| Bull Shoals | White | 160,000 | 184,000 |
| Denison | Red | 70,000 | 80,000 |
| Fort Gibson | Grand | 45,000 | 48,000 |
| Norfork | White | 70,000 | 80,000 |
| Tenkiller Ferry | Illinois | 34,000 | 39,000 |
| Subtotal | | 379,000 | 431,000 |
| Isolated plants: | | | |
| Blakely Mountain | Ouachita (Red) | 75,000 | 75,000 |
| Narrows | Little Missouri | 17,000 | 17,000 |
| Whitney | Brazos | 30,000 | 30,000 |
| Subtotal | | 122,000 | 122,000 |
| Total hydroelectric | | 501,000 | 553,000 |
| Steam: | | | |
| Central Electric Power Cooperative | | 15,000 | 16,000 |
| W. Electric Power Cooperative, Inc. | | 40,000 | 42,000 |
| Western Farmers Electric Cooperative | | 30,000 | 30,000 |
| Total steam | | 85,000 | 88,000 |
| Grand total | | 586,000 | 641,000 |

The hydroelectric capacity of 501,000 kilowatts, shown in the tabulation, will be increased by 100,000 kilowatts early in 1960 when the first two generating units of the Table Rock project on the White River in Missouri are completed. A further increase of 190,000 kilowatts will be available by the end of 1961 upon completion of additional 100,000 kilowatts at Table Rock and the additional 90,000 kilowatts at Bull Shoals.

ENERGY PRODUCTION

Hydroelectric Projects

On July 1, 1957, water levels at all reservoirs were above the top of power pools as the result of the heavy runoffs which occurred during April, May, and June. Flood storage drawdown was not completed at some projects until October 15, and reservoir levels remained high through the fiscal year. River flow conditions at the various projects are shown below.

| Project and State | Stream | Percent median flow July 1, 1957 to June 30, 1958 |
|---------------------------------|----------------------|---|
| Blakely Mountain, Arkansas..... | Ouachita..... | |
| Bull Shoals, Arkansas..... | White..... | |
| Denison, Oklahoma-Texas..... | Red..... | |
| Fort Gibson, Oklahoma..... | Grand..... | |
| Narrows, Arkansas..... | Little Missouri..... | |
| Norfork, Arkansas..... | North Fork..... | |
| Tenkiller, Oklahoma..... | Illinois..... | |
| Whitney, Texas..... | Brazos..... | |
| Weighted system average..... | | |

The net generation for the 1958 fiscal year for each project is shown in the following tabulation. The total net hydroelectric generation amounted to 2,056,026,850 kilowatt-hours of which 1,749,985,900 kilowatt-hours were from the interconnected system.

| Project: | Net generation fiscal year 1958 (Kilowatt-hours) |
|------------------------|--|
| Interconnected system: | |
| Bull Shoals..... | 991, 706, 000 |
| Denison..... | 245, 386, 000 |
| Fort Gibson..... | 146, 717, 000 |
| Norfork..... | 248, 210, 000 |
| Tenkiller Ferry..... | 117, 966, 000 |
| Subtotal..... | 1, 749, 985, 000 |
| Isolated plants: | |
| Blakely Mountain..... | 176, 976, 000 |
| Narrows..... | 45, 838, 000 |
| Whitney..... | 83, 226, 000 |
| Subtotal..... | 306, 040, 000 |
| Total..... | 2, 056, 026, 000 |

Small Plants

The amounts of energy generated by these plants for marketing during fiscal year 1958 are shown in the following table:

| | <i>Net generation, fiscal year 1958, kilowatt-hours</i> |
|--|---|
| Central Electric Power Cooperative (Chamois, Mo.) | 37, 291, 000 |
| N. W. Electric Power Cooperative, Inc. (Missouri City, Mo.) .. | 100, 749, 000 |
| Western Farmers Electric Cooperative (Anadarko, Okla.) | 45, 047, 000 |
| Total | 183, 087, 000 |

MARKETING

During the 1958 fiscal year billing periods, the Southwestern Power Administration had available for sale, before losses, a total of 2,263.9 million kilowatt-hours of energy, of which 248.3 million kilowatt-hours represented purchases or withdrawals and 2,015.6 million kilowatt-hours¹ represented hydroelectric energy. After losses, a total of 2,066.8 million kilowatt-hours was marketed. Of this amount, 1,667.0 million kilowatt-hours of firm energy, and 509.8 million kilowatt-hours of secondary energy were delivered to customers. Energy deliveries to preferred customers amounted to 1,443.8 million kilowatt-hours, equivalent to 71.6 percent of the total hydroelectric energy available for sale, or 63.8 percent of the total energy available for sale. The attached graph shows the distribution of energy among preferred customers, private utilities, and the Arkansas Power & Light Co.—Reynolds Metals Co. under the "Aluminum" contract, and portrays the growth and achievement of Southwestern Power Administration in selling increasing amounts of power and energy to preferred customers.

Revenues from power sales amounted to \$13,385,999 (\$9,802,587 from sales to preferred customers, \$1,361,555 from sales to private utility companies, and \$2,221,857 from sales under the "Aluminum" contract).

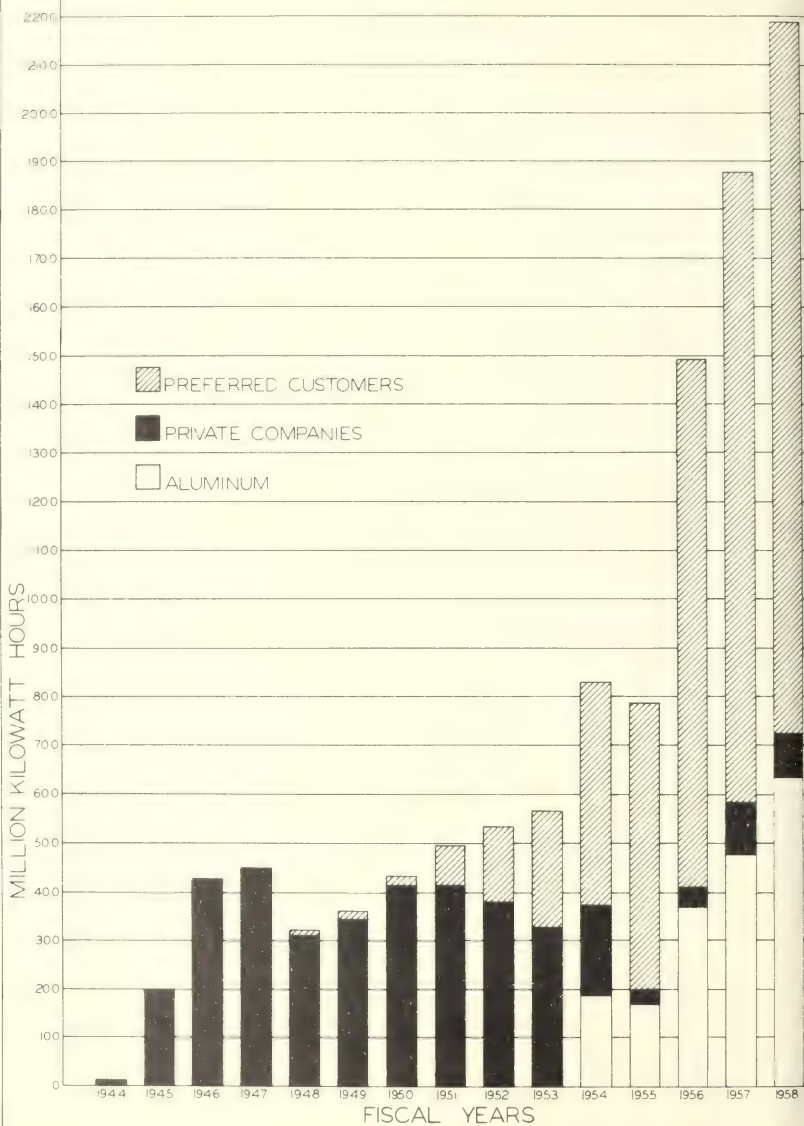
Service totaling 5,500 kilowatts was begun to two new preferred customers (City of Bentonville, Ark., and Kay Electric Cooperative, Muskogee, Okla.), and 500 kilowatt service to one preferred customer (City of Anadarko, Okla.) was terminated by mutual agreement.

At the end of fiscal year 1958, the power commitments to preferred customers served by Southwestern Power Administration totaled 1,855 kilowatts, and were distributed as follows:

| | <i>Kilowatts</i> |
|---|------------------|
| distribution and G & T Cooperatives | 246, 340 |
| municipalities | 44, 695 |
| military installations | 10, 820 |

Adjusted under the provisions of the exchange agreement with Arkansas Power & Light Company with regard to the Blakely Mountain project.

ENERGY SALES BY MAJOR CUSTOMER GROUPS



Contracting

During the fiscal year 1958, new agreements became operative with the Western Farmers Electric Cooperative in Oklahoma, the Central Electric Power Cooperative in Missouri, and the Sho-Me Power Corporation in Missouri. The new agreements provide for the installation of additional generating units to be built by the cooperatives, release the Government from previous agreements to lease the capacity of certain of the cooperatives' 69 kilovolt transmission facilities. In lieu thereof, the cooperatives transmit power and energy over such facilities for certain transmission charges.

A contract was negotiated with one new preferred customer, the May County Electric Cooperative, with 3,500 kilowatt load. This customer will be served through facilities of the Oklahoma Gas & Electric Co.

Existing contracts with various customers were amended to provide for seven new delivery points and to abandon two old delivery points. Contract obligations were increased by 35,310 kilowatts.

Short term agreements were entered into with preferred customers whereby they will be able to benefit from use of dump energy and interruptible capacity.

The integration of systems in the Southwest was advanced in fiscal year 1958 as a result of the interconnection agreement completed with the Grand River Dam Authority, and the Northeast Missouri Electric Power Cooperative, Palmyra, Mo. In addition to strengthening the systems by interconnection, these interconnections provide additional market to the Government for the disposition of interruptible capacity and excess energy and they provide a source of excess energy that may be obtained by the Government when desirable and available.

Rates

Rate Schedule "A", which had been in effect since February 1947 in general service to preferred customers, was superseded in August 1947 by two new rate schedules, namely "P-1" for peaking power and "F-1" for firm power. The "P-1" rate schedule is designed for service at 1,800, but not to exceed 2,400, hours use per kilowatt per year. The base "F-1" rate schedule averages 6.97 mills per kilowatt-hour at 50 percent load factor, as compared with the 5.51 mills per kilowatt-hour return realized under Rate Schedule "A". Both the "P-1" and "F-1" rate schedules provide for discounts should the customer reduce the Government of various transformation, substation or transmission costs. Sales under the "A" and "F-1" rate schedules accounted for 58.6 percent of the total energy sales and 68.9 percent of the revenue for the year.

During the year, the "EE" rate schedule for excess energy became effective with an energy charge of 1.5 mills per kilowatt-hour, superseding "EE Temporary" with an energy charge of 1.25 mills per kilowatt-hour.

A new rate schedule, "IC", for the sale of interruptible capacity became effective, with a capacity charge of 4.5 cents per kilowatt-day under which sales were made to an REA cooperative, and a municipality.

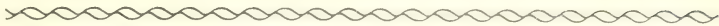
Total secondary energy and interruptible capacity sales for the year amounted to \$620,998, exclusive of contracts under which lump-sum payments are made for primary and secondary sales.

An upward revision of the rates and charges became effective with the contract with the Oklahoma Gas & Electric Co. and the Public Service Co. of Oklahoma (Oklahoma Companies Contract) and the contract with the Texas Power & Light Co., while a new contract with the Southwestern Gas & Electric Co. became effective with the December 1957 billing period. This latter contract is an arrangement similar to the aforementioned Oklahoma and Texas Power & Light Co. contracts. The other agreement with Southwestern Gas & Electric Co., for the disposition of the output of the Narrows project, was given a 1-year extension from August 9, 1957, until a supplemental agreement could be consummated with the company.

On August 9, 1957, the Federal Power Commission dismissed the request of the Department for a determination that the rates specified in the contract with Arkansas Power & Light Co. and Reynolds Metal Co. ("Aluminum" contract) be no longer effective and applicable to Energy sales to Arkansas Power & Light Co. were 29.4 percent of total sold during the year and accounted for 16.6 percent of the yearly revenue.

SOUTHEASTERN POWER ADMINISTRATION

Chas. W. Leavy, *Administrator*



RING FISCAL YEAR 1958, Southeastern Power Administration marketed 1,169,910 kilowatts of capacity (with peak generation 1,502,140 kilowatts) and 4,009,375,550 kilowatt-hours of energy. It was sold to 52 public bodies, 74 rural electric cooperatives, 1 Federal agency, and 6 privately owned utilities. Water conditions were favorable at most of the projects during the year and the sales earned \$1,006,631.67. This was an increase of \$5,362,419.90 over earnings the previous year, and brought revenues earned in all years to total \$1,823,104.40.

The output was generated at 10 Corps of Engineers projects. They are the Wolf Creek, Dale Hollow, Center Hill, and Old Hickory projects in Kentucky and Tennessee, the Allatoona and Buford projects in Georgia, the Clark Hill project in Georgia and South Carolina, the Jim Woodruff project in Florida, the John H. Kerr and Holpott projects in Virginia.

The installed generating capacity of 1,126,000 kilowatts at the beginning of the fiscal year was increased to 1,247,000 kilowatts during the year by installations at the Old Hickory and Buford projects and construction by the Corps continued on four other projects (Cheatham in Tennessee, Walter F. George in Georgia and Alabama, Hartwell in Georgia and South Carolina and Barkley in Kentucky). The construction under way will add 494,000 kilowatts of installed capacity.

The combined output of Wolf Creek, Center Hill, and Dale Hollow projects continued to be sold to the Tennessee Valley Authority under a long-term contract. During the year a new long-term contract with the Authority providing for the sale of the combined output of the Old Hickory and Cheatham projects was executed. All of the Holpott project output was sold to Appalachian Electric Power Co.

under temporary arrangements pending the conclusion of negotiations for long-term sales. Two-thirds of the Kerr project's output continued to be sold under long-term contracts to the Virginia Electric and Power Co., and to 17 cooperatives in Virginia and North Carolina and the remainder continued to be sold under long-term contracts to Carolina Power & Light Co. and 16 public bodies and cooperatives in North Carolina. Part of the Clark Hill project output was sold under long-term contracts to two public bodies in South Carolina. The one-half of the output of the Clark Hill project to be marketed in Georgia and the entire output of the Allatoona and Buford projects were sold under new long-term contracts executed during the year with Georgia Power Co. and 86 public bodies and cooperatives in Georgia. The output of the Jim Woodruff project was sold under long-term contracts executed during the year with Florida Power Corp. and six public bodies and cooperatives in Florida.

The Congress appropriated for the fiscal year \$258,000 for headquarters operation and maintenance, and \$2,040,000 for the purchase of firming energy and the payment of wheeling fees. Southeastern's working force numbered 35 employees at the beginning of the fiscal year and 36 employees when the year ended.

DEFENSE ELECTRIC POWER FUNCTIONS

THE ADMINISTRATION of electric power functions is vested in the Secretary of the Interior under the Defense Production Act, previous Executive Orders, and delegations from the Office of Civil Defense Mobilization. The Assistant Secretary—Water and Power Development—exercises direct supervision over these functions. Activities in the defense electric power field are concerned with planning to assure an adequate power supply, including generation, transmission, distribution and utilization thereof, for the Nation under mobilization conditions.

Under Office of Civil and Defense Mobilization delegations, the Department has responsibility for: (1) planning a national program, providing technical guidance to the States, directing Federal activities concerned with emergency restoration of electric service to attacked areas and provision of adequate electric utility service to support areas; (2) providing guidance and leadership to the power industry in the development of plans and programs to insure the continuity of essential electric power production in event of attack; (3) developing and maintaining programs for operation of electric utilities under mobilization conditions; (4) developing, assembling, and evaluating data as to the production capacity of electric utilities; (5) analyzing the problems involved in maintaining adequate reserve capacity and recommending necessary programs; (6) assembling data requirements for electric power; (7) developing, assembling, and evaluating data as to materials, equipment, transportation, and other requirements for the electric power industry under mobilization conditions; (8) cooperating with the Office of Defense and Civilian Mobilization and other appropriate agencies in planning production and distribution controls; (9) advising with respect to orders, regulations, and directives as they may affect the electric power industry.

The Department has continued its program of preparing for the establishment of a central agency at a relocation site and defense electric field area organizations throughout the Nation ready to function

in the event of an attack in order to provide, to the extent possible, electric power to essential services.

A survey of survival items in utility warehouses is progressing. The Inter-Agency Committee on Essential Survival Items established by OCDM, agreed on a list of power items. The items include the material and equipment needed for the repair and construction of facilities for transmission and distribution of essential power for survival and restoration requirements in a post-attack period.

Progress has been made for a survey of comprehensive data on electric generating plants and substations for bomb damage assessment. The survey will be made with the cooperation of the Federal Power Commission, and coverage will include generating stations of 10,000 kilowatts and over, whether owned or operated by utility systems or industry. The number of stations covered will be about 1,000 which will embrace approximately 96 percent of the total capacity in the Nation. Also covered will be all substations of 25,000 kilowatts and over.

OFFICE OF SALINE WATER

David S. Jenkins, *Director*

THE CONTINUOUSLY INCREASING demand for fresh water due to the expansion of industry, population, and agriculture, as well as the expansion of man's activities into regions not supplied with this natural resource, emphasizes the need of conserving this vital water resource and developing new sources through conversion of saline waters. In recognition of this need and in view of the potential benefits to be gained, Congress in 1952 authorized a research and development program having as its objective the development of low-cost processes for converting saline waters to fresh water by enacting Public Laws 448 (1952) and 111 (1955).

Whatever the source of saline water (sea or brackish), it is comparatively stable and the salts are held tenaciously in solution. Separation of the salts from water, therefore, requires relatively large quantities of energy. Thus the problem of conversion is a difficult one primarily because any process developed must result in low-cost water and it must be economically competitive with natural processes.

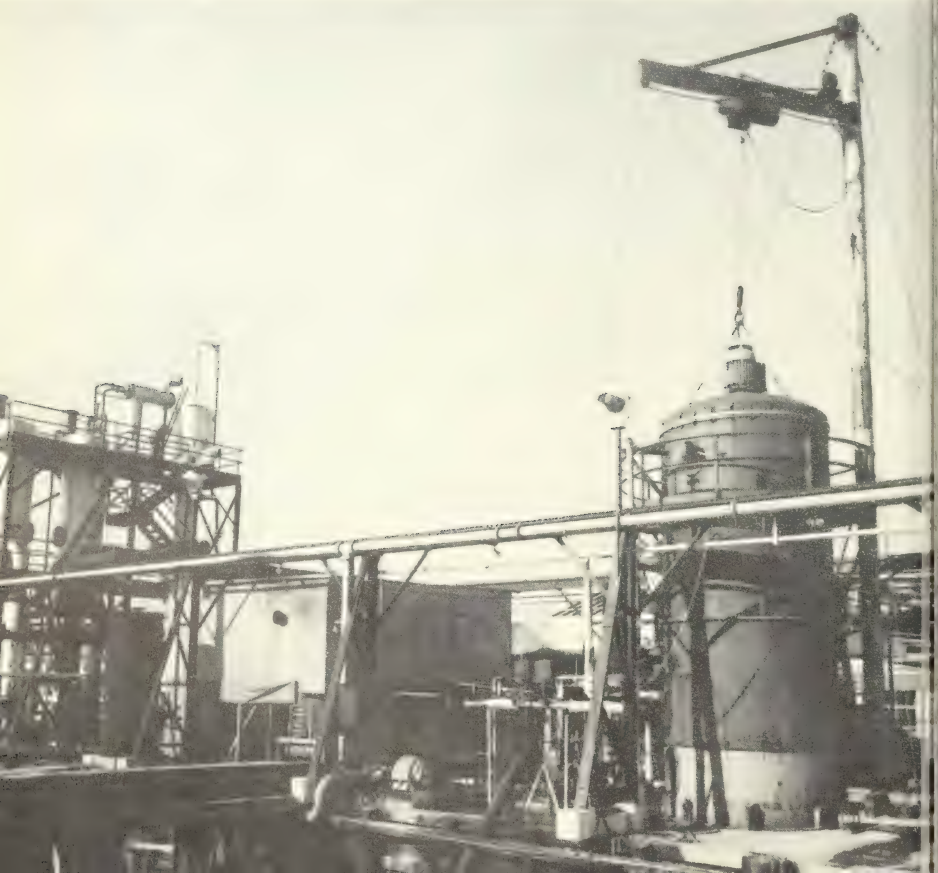
Progress toward the solution of this problem is being made and several conversion processes under study look promising. During the past year, several projects have moved forward in the field of distillation, with satisfactory results. The Whiting Corp. and W. L. Langer & Associates have assembled and placed in operation the large-scale vertical evaporation experimental equipment and are testing large-scale prevention techniques and materials corrosion on natural sea water at Wrightsville Beach, N. C. The unique Hickman multi-effect pilot plant was also moved to that sea water test site and is presently undergoing an extensive test program by the Battelle Memorial Institute. The Griscom-Russell Co. completed an initial study of single-effect flash low-thermal-difference evaporator design with promising results and The Fluor Corp. completed a preliminary optimization study of related combination nuclear reactor-saline water dis-

tillation cycles. The Atomic Energy Commission furnished technical support for the latter study. During this period investigations were also conducted in the field of forced-circulation and dropwise condensation evaporation and partial-pressure distillation using water-miscible solvents.

A development program on solar distillation was initiated this year wherein prototypes of various designs of solar stills are to be operated and further developed at a seashore test site near Port Orange, Florida. Battelle Memorial Institute is carrying out the program and has plans ready for the construction of the first small pilot plant. E. I. du Pont de Nemours Co. is continuing cooperation in research on applications of plastics materials. Other work on new designs for prototypes continues.

Research investigations have demonstrated that processes utilizing membranes are technically feasible and at present one appears to

SALINE WATER CONVERSION PILOT PLANTS.—The test evaporators shown above are located at the International Nickel Co. Laboratory, Wrightsville Beach, North Carolina. *Left:* W. L. Badger long-tube vertical evaporator testing scale and corrosion prevention methods. *Right:* The 25,000 gallon/day Hickman rotary vapor compression still.



omically feasible for brackish waters under certain conditions. These processes consist of electrodialysis, osmionic and reverse osmosis. As a result of considerable research by several organizations (government and private) aimed at improving the characteristics of the membranes used in these processes, greatly improved ion-selective membranes have been developed. Ion-selective membranes are now available in quantity, at a cost per unit area of approximately one-fifth of former price. This is encouraging since the cost of the membranes in these processes represents a considerable portion of the total cost of purified water.

Membrane durability tests on the Ionics, Inc., demineralizer and the membrane evaluation program were continued during this period at the Bureau of Reclamation Laboratories in Denver, Colo. Two N. O. electrodialysis units (a small experimental cell and a laboratory pilot plant) were ordered and will be tested in the Reclamation Laboratories during the coming year.

The work at Southern Research Institute involving the design, construction and testing of a practical osmionic unit (an osmotically covered process) was continued. A laboratory unit was fabricated which demineralized brackish water at a rate close to that postulated by theory. The development of an improved unit involving clamped-tube unit cells is now under way.

The work at the University of Florida on reverse osmosis was continued and efforts were concentrated on the synthesis of improved ion-exchanging membranes.

An investigation of the feasibility of using algae in saline water concentration was initiated by Resources Research, Inc. Preliminary results have shown that several types of algae grown in sea water develop to moderately dense to dense cultures.

An exploratory study involving electrical control of adsorptivity of porous conductors was initiated by the University of Oklahoma Research Institute.

The inherent advantages of using freezing as a separation process are coming closer to practical realization by the development of a successful ice crystal washing technique by the Carrier Corp. in their research on the combination freeze-evaporation process. Preliminary design of a pilot plant is under way. Another approach to the use of freezing, involving an immiscible refrigerant vaporized in direct contact with the saline solution, is being investigated at Cornell University. The initial phases of the zone-purification research were conducted by Battelle Memorial Institute with results showing some possibilities for a process but with a recommendation for further study of possible economic feasibility. Applied Science Laboratories and the University of Iowa concluded on ice crystal formation.

Research on solvent extraction process was continued by Texas A & M Research Foundation with emphasis on synthesis of more efficient solvents and application of the process to brackish waters.

A symposium on saline water conversion, jointly sponsored by National Academy of Sciences, National Research Council, and Office of Saline Water was held November 4-6, 1957. The symposium brought together scientists and engineers from the United States and abroad working on, or interested in the conversion of saline water to fresh water. The papers presented appear in the published Proceedings which can be regarded as representing the current state of knowledge in this field.

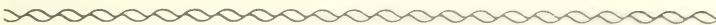
During the coming year increased emphasis will be placed on development and operation of pilot plants but both fundamental and applied research on the problem will be continued.

To expand and supplement the current research and development activities in this field, Congress has had under consideration during the present fiscal year legislation providing for the construction of demonstration plants in saline water conversion. Hearings have been held in both the House and the Senate on bills covering the demonstration plants. This legislation which was pending final passage at the end of the fiscal year, would authorize the Secretary of the Interior to provide for the construction, operation, and maintenance of not less than five demonstration plants, two for brackish waters and three for fresh water with funds authorized to the extent of \$10,000,000 for construction. Provision is further made for selection of sites for the plants, size of plants, and the time schedule for selecting the processes. A period of 7 years is provided for carrying out the construction and operation of the demonstration plants.

Office of the Assistant Secretary

Mineral Resources

Royce A. Hardy, *Assistant Secretary*



THE ASSISTANT SECRETARY for Mineral Resources discharges the responsibilities of the Secretary of the Interior with respect to the Department's programs in the field of the development and utilization of minerals and metals, including mineral fuels. He exercises supervision over the Geological Survey, the Bureau of Mines, the Defense Minerals Exploration Administration, the Office of Oil and Gas, the Office of Minerals Mobilization, and the Division of Geography.

The Assistant Secretary serves as the principal spokesman for the Department of the Interior in the field of mineral affairs at the policy-making level within the Federal Government. He participates in meetings of the Council on Foreign Economic Policy as the Department's liaison representative, and sits frequently with the Defense Mobilization Board as problems involving minerals and fuels are considered.

The Office coordinates the Department's representation on the Advisory Committee for Export Policy and its operating committee. These interdepartmental advisory committee are utilized by the Department of Commerce in carrying out its responsibilities under the Export Control Act of 1949. Substantial progress was made during the year toward relaxation, and where possible elimination of export controls.

In addition to the foregoing responsibilities, the Office of the Assistant Secretary, Mineral Resources, is the principal point of contact between the Federal Government and the mineral industries. The Assistant Secretary establishes and maintains liaison with representatives of the industry.

The Office of the Assistant Secretary, Mineral Resources, continued its work during the fiscal year on the development of proposals for a

long-range minerals program. On April 28, 1958, Secretary Fred Seaton presented the Minerals Stabilization Plan to the Congress. The plan called for stabilization payments for lead, zinc, fluorine and tungsten, and for purchases to stabilize the domestic copper industry. Progress was made toward the goal of intensification and acceleration of the Bureau of Mines and Geological Survey program of research and toward securing passage of a program of financial assistance to private firms for mineral exploration projects. A review of the mining and leasing laws and laws dealing with taxation of mining enterprises was undertaken.

The detailed review of the helium supply and requirements situation which was initiated in cooperation with other Government agencies in the past fiscal year was substantially completed. The problem of helium conservation was given intensive study, and a long-range program was developed and approved by the President. The Office of the Assistant Secretary played a substantial role in developing a legislative program which would authorize implementation of the approved helium conservation program.

The Office participated extensively in interdepartmental discussions dealing with petroleum supply requirements problems.

The Office of the Assistant Secretary, Mineral Resources, continued to supply information and advice to the Director of the Office of Civil and Defense Mobilization concerning administration of the Government's long range strategic stockpiling program. The Office maintained a review of the overall stockpile situation and was active in the development of modifications in stockpile policy.

The Office took an active role in dealings with the Department of Agriculture with respect to acquisition of strategic and critical material for the supplemental stockpile through barter transactions.

The Office continued to exercise surveillance over the administration of the Domestic Tungsten, Asbestos, Fluorspar and Columbium-Tantalum Production and Purchase Act of 1956 (Public Law 84th Cong.). Adequate funds were available during the fiscal year for purchases of asbestos, fluorspar, and columbium-tantalum. The Department's efforts to obtain funds to continue the purchase program for tungsten did not meet with success.

The Office continued to participate in the Department's post-attack planning program. Staff members from the Office were active in planning and administering Operation Alert 1957. A staff member served as Deputy Administrator of the Department's defense agency.

The Office of the Assistant Secretary aided in the preparation of the Department's report and testimony on the extension of the Reciprocity Trade Agreements Act. The Office also coordinated studies and analyses of the tariffs on several minerals and metals as a basis for developing the Department's position relative to proposed legislation.

GEOLOGICAL SURVEY

Thomas B. Nolan, *Director*



AMERICA enters the age of space, new demands are being made for our mineral, mineral fuel, and water resources as well as increasing demands for geographic and topographic information of the highest quality. The Geological Survey of the Department of the Interior, one of the basic research agencies of government, has unique responsibilities in the search for new supplies and appraising known supplies of mineral and mineral fuels, for determining the quantity and quality of our water supplies, for mapping the surface features of the United States, and in mineral development on public lands. By its investigations and research in methods and techniques, the Survey shares in the task of promoting national economic security and defense.

Geologic investigations and research are primary requisites in the search for mineral raw materials. The work done by the Survey in determining guides to ore deposits and the development of prospecting methods and techniques is important to the establishment of the resources that enable our mineral using industries to keep abreast of scientific and technologic advances.

The problem of adequate supplies of water for both industrial and domestic use has become a critical one. The Survey is meeting the demand and for the solution of complex water problems by giving increased attention to analytical, interpretive, and research phases of water resources investigations.

The need for adequate topographic map coverage is being met by intensive use of newly developed photogrammetric and field equipment. New devices have not only improved the quality of topographic maps, but also have increased the rate of production.

The following report summarizes the technical and publication activities of the Survey during fiscal 1958, the 79th such report since the Bureau was established in 1879.

GEOLOGIC DIVISION

During fiscal year 1958, the Geologic Division continued its investigation and appraisal of the mineral resources of the Nation through its research program of geologic mapping and related field and laboratory investigations. Particular emphasis is being placed on the refinement and development of techniques to aid in the exploration for metals and fuels. The need for geologic information to aid the search for these resources becomes increasingly more critical with the passage of time and the exhaustion of readily exploitable deposits.

In addition to its regular program of research, the Division continued to provide technical data and evaluations to many other government agencies; nearly half of the Division's total funds were expended on work for these agencies. The largest program was for the Atomic Energy Commission which consisted of a broad group of research studies in fissionable materials, both in the field and in the laboratory. Data and services were provided to the Armed Forces, the International Cooperation Administration, the Defense Minerals Exploration Administration, the Office of Minerals Mobilization, the Bureau of Public Roads, the General Services Administration, and others. As in past years, Survey geologists also served as consultants to the National Science Foundation and various defense agencies.

Twenty-six professional papers, 58 bulletins, 149 maps and 3 circulars were published in the regular Survey series of publications. In addition, 46 reports were placed on open file, and 556 papers or reports were published in scientific journals.

Mineral Deposit Investigations

Field and laboratory research investigations continue to increase the supply of basic data necessary for the understanding and appraisal of our mineral resources. Progress was made in the study and the understanding of known mineral deposits, the key to developing techniques useful in the search for new resources.

A total of 126 projects were active. Twenty were conducted in cooperation with states, and 27 were supported by the Atomic Energy Commission. Geologic mapping was in progress in many mining districts such as the Laguna and Grants areas (uranium), New Mexico. Other projects entailed mapping in the vicinity of centers of ore production in an attempt to clarify the principles controlling large ore concentrations. For example, mapping in the Holy Cross quadrangle, Colorado, has revealed a several-mile-wide shear zone aligned with the trend of the Colorado Mineral Belt. This zone may have controlled the emplacement of the mineral deposits. Other

ects are directed toward a better understanding of areas of high mineral potential. Geologic mapping on the Boulder Batholith in Montana has shown that younger rocks west of Butte may conceal extensions of this major copper district. Determination of the underlying bedrock and its mineral potential has been carried on with considerable success in North Carolina through heavy mineral and geological studies of soils and vegetation.

Of outstanding scientific significance is the discovery that in the metasomatism of carbonate rocks in the Little Dragoons Mountains, Arizona, volume changes have occurred during alteration.

Criteria have been proposed to distinguish between the various types of waters that originate deep within the earth and that could be involved in ore deposition. The tiny inclusions of these waters containing many ore minerals are now being tested against these criteria to provide one more clue to the origin of mineral deposits.

Increasing demand for boron for use in fuels has led to studies aimed at appraising our boron resources and their mode of occurrence. Other resource studies permit continuing appraisals of the country's production with regard to mineral commodities. Studies for the production of the Defense Minerals Exploration Administration contributed to one of the most significant discoveries of lead ore made in the United States during the present century. This discovery is in the Iron Mountain area of southeastern Missouri and gives promise of being more productive than the already well known belt of that area.

Five geochemical exploration projects were in progress during the year. Rapid laboratory and field methods of trace analysis were developed for mercury and tin in soils and rocks, a new and more accurate analytical technique was perfected for chemical determination of lead and zinc in the presence of interfering elements, and the precision and accuracy of the field spectroscope has been greatly improved. More than 20,000 trace analyses were made. Survey analytical methods and techniques are being widely adopted by mining companies, other Government agencies, and universities both in the United States and foreign countries.

Fifteen geophysical projects were in progress involving airborne and ground magnetic and radioactivity surveys as well as development of new exploration methods and instruments. A development of particular interest is in the indication that the grade of some types of copper ore can be determined at a mine face by induced polarization measurements.

Twenty-seven maps in the geophysical investigations series showing aeromagnetic results in mineral areas were published during the year.

More than 40 projects were in progress in the fields of geochemistry and petrology and nearly 22,000 supporting analyses, including stratigraphic, radiometric, X-ray, mineralogical, and age determinations as well as chemical analyses were made. Sixteen thousand thin polished sections of rocks and ore were prepared for microscopic study. Faster and more accurate methods continued to be developed for the analysis of important materials such as selenium, chromium ores, boron, and thorium. An outstanding development in laboratory technique was a precision-controlled furnace mounted with an X-ray diffraction apparatus for studying the behavior of mineral specimens at temperatures up to 1,000° centigrade.

Field and laboratory studies resulted in greatly increased understanding of the processes by which uranium, phosphate, boron, and vanadium ores were deposited. Numerous new minerals were discovered, and their atomic structures were determined. The alpha method for age determination of rocks, developed by the Geophysical Survey, was used to supply valuable age data on New England granites and on the batholiths of western United States and Alaska. A study of pyrite, sphalerite, and associated sulfide minerals has resulted in new approaches to "geologic thermometry" to provide new data on the temperatures of ore deposition.

Mineral Fuels Investigations

Work continued in potential oil and gas producing areas to provide information needed in formulating exploration programs. Map geologic and stratigraphic studies were conducted in 29 petroleum-producing or potentially producing States. In six States the work was done cooperatively with State agencies.

Studies in New York, made primarily to determine the potential oil-shale resources, have developed new concepts of the correlation of Devonian rocks that will be important to future exploration for oil and gas throughout the entire northern Appalachian region. Structural studies in the Wind River Basin, Wyoming, suggest that some rock masses formerly considered to be overthrust remnants are actually ancient landslides. This concept will result in new appraisal of resource potential.

Studies of Upper Cretaceous black sands in Wyoming, done in cooperation with the State, show that these sands mark ancient shorelines which are often reservoirs for petroleum.

A folio of paleotectonic maps and charts synthesizing stratigraphic data on the Triassic system in the United States is nearing completion. Similar work continues for the Permian and Pennsylvanian systems. Eight new projects included a stratigraphic study in

thern Appalachians and an evaluation of the petroleum possibilities of the Atlantic Coastal Plain and Continental Shelf.

Investigations of coal bearing areas in 13 States included appraisals of coal resources in five. Revision of the coal map of the United States neared completion. In eastern Pennsylvania studies continued that are designed to furnish data to the Bureau of Mines to aid in a program of protecting anthracite coal mines from flooding.

Gravity and aeromagnetic surveys in potential mineral fuel areas in New Mexico were completed and 2 reports were published describing techniques of regional importance in the interpretation of gravity and magnetic features that may aid mineral fuel exploration.

General Service Geology

Basic functions of general service geology include obtaining geologic data needed in planning civil engineering works and programs for water and land utilization, and fundamental research in various fields of the geologic sciences.

During the year engineering geologic investigations continued in 9 metropolitan areas and in 8 additional areas in Montana, Nebraska, and Colorado. Cooperative geologic mapping programs with Massachusetts, Rhode Island and Connecticut are continuing. Geologic information on selected sites was made available as needed to Federal and State construction agencies.

Basic research in engineering geology emphasized landslides and mudflows, rates and causes of cliff erosion, and the application of mathematical theories of plasticity to solution of structural geologic problems. Final reports on the engineering geology of the Air Force Academy site neared completion. Several investigations of construction sites were made for the Federal Housing Administration, and a week school in the fundamentals of geology was offered to engineers of that agency. Geophysical, geochemical, and engineering studies of the pre-shot and post-shot geologic conditions in the area affected by the underground nuclear explosion at the Nevada Test Site were continued for the Atomic Energy Commission.

General geologic investigations included studies in volcanology, metamorphism, structural geology, surficial geology, glacial geology, and the geology of soils as well as service and research activities in paleontology and stratigraphy, geochemistry and petrology, and geophysics. Much of this work gives background data that tie together the geology of areas of known resource potential. Such studies have frequently yielded unpredicted but important economic results, and until investigations of this sort have been made, no area can be eliminated as a source of mineral wealth. Field work on 2

areas was completed and studies of 5 new areas were begun. Scientists at the Hawaiian Volcano Observatory continued their observations of the active volcanoes there, in further efforts to comprehend the mechanism of volcanic activity which may ultimately lead to more accurate predictions of activity.

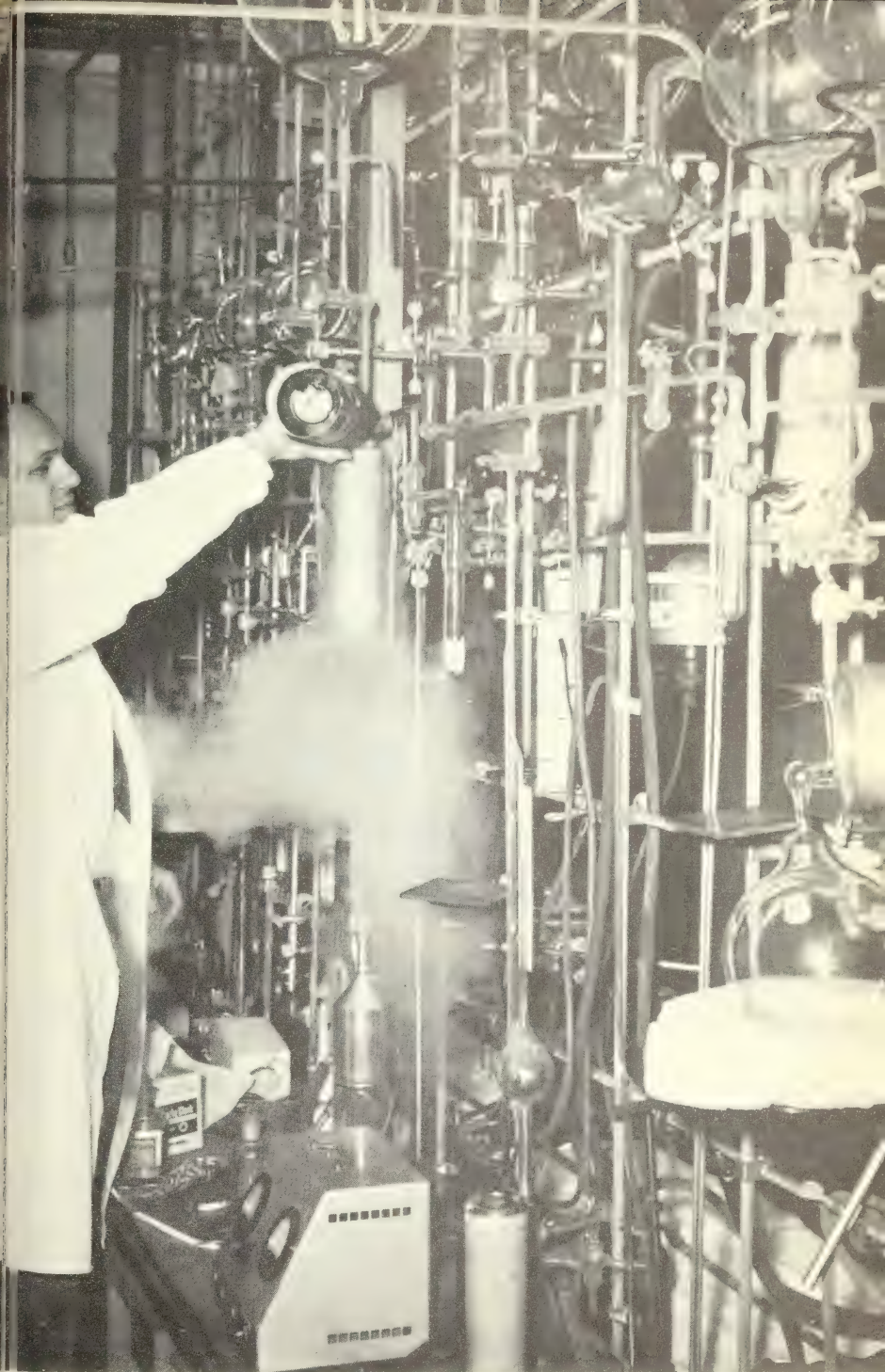
In the field of geochemistry and petrology cooperative work with other Government agencies included extensive field and laboratory work on such problems as radioactive waste disposal. Work on radiocarbon dating, focused primarily on reconstructing the geologic and climatic history of the glacial age, was useful in archeology and meteorology as well as in economic and engineering geology and hydrology. An X-ray study of foraminifera showed that their magnesium contents gave a basis for their division into two groups, corresponding to their natural classification.

Laboratory studies of core samples and electric logging in drill holes were continued to learn electrical properties of rocks and minerals in selected areas such as the iron ore deposits of Minnesota and Wisconsin. Electromagnetic geophysical methods were tested in field areas of widely divergent rock types and laboratory model studies for determining the application of electromagnetic methods were begun.

Alaskan Mineral Resources

Alaskan activities were directed primarily toward appraising and aiding in the discovery and development of mineral resources, as well as toward providing the needed geologic basis for industrial and agricultural expansion. About 1,500 square miles of geologic mapping was accomplished by ground and photogeologic methods.

The discovery in 1957 of a 900-barrel-per-day oil well in the Kertou Peninsula has stimulated interest in Alaska's potential petroleum resources. Field work and preparation of reports were in progress on the Nelchina area, the Iniskin-Tuxedni area, the Gulf of Alaska region, and the Koyukuk Basin. Final reports were in preparation on investigations in Naval Petroleum Reserve No. 4. Preparation of a summary report on Alaskan coal resources continued. Detailed studies were continued in the Tofty-Eureka gold and tin district and systematic mapping in areas of tungsten mineralization north of Nome was completed. Report preparation continued on the tin deposits on western Seward Peninsula. Soil, plant, and stream sediment geochemical studies were in progress to determine the applicability of such techniques in northern latitudes. The initial products of an analytical study of Alaska's metallogenic provinces



chronologist of the Geological Survey's—Low Level Radiation Laboratory shown using the Carbon 14 method of age determination for dating organic specimens of geologic and archeologic importance.

consisting of 3 commodity maps showing the occurrence and distribution of known occurrences of 10 metals, are nearing completion.

Activity on behalf of the Defense Minerals Exploration Administration and investigations of radioactive deposits on behalf of the Atomic Energy Commission were continued at a reduced scale. Detailed mapping was near completion in the vicinity of Alaska's producing uranium and thorium deposit at Bokan Mountain. Geologic and geophysical studies were carried out for the Atomic Energy Commission under project "Plowshare" which is directed toward developing peaceful uses of atomic energy.

Engineering geologic investigations included mapping of surficial deposits of approximately 100 square miles near Fairbanks and about 80 square miles adjacent to the Alaska Railroad. Investigations were made for the Bureau of Reclamation in the vicinity of the proposed Devil Canyon and Denali damsites to provide geologic information for use in planning and construction. Detailed geologic maps of proposed bridge sites along the highway from Neris to McKinley National Park were prepared for the Bureau of Public Roads.

Airborne magnetic and radioactivity surveys were made; results of an earlier survey were published in a regular map series and the results of five other surveys were placed on open file. 10 bulletins resulting from Arctic Ice and Permafrost Investigations were published. Collection and processing of thermal data continued. Report preparation on the results of the Aleutian studies neared completion and one bulletin was published.

Long Range Minerals Program

The primary objectives of the Long Range Minerals Program include acceleration of geologic mapping and research, and development of geochemical and geophysical theories and techniques, to exploration activities aimed at the discovery of new mineral areas of critically short materials essential to national security.

During the fiscal year, geologic mapping projects were under way in 20 areas in the United States and Alaska, and research studies in methods of ore finding were carried on in 16 projects. Each of the projects was accorded appropriate geochemical, mineralogic, geophysical, and paleontologic support. Two thousand two hundred square miles of geologic mapping was completed including studies in Montana from which a regional pattern is being developed for a better understanding of the mineral deposits.

Studies on the dispersion of minor elements in igneous rocks in the Colorado Front Range have developed relationships that should be valuable guides to future exploration in the belt. A method was



Use of a helicopter and power barge speeds regional mapping of Southeastern Alaska for Long Range Minerals Program.

Developed for measuring the magnetic susceptibility of rocks in drill cores, and photogrammetric techniques were developed for making terrain corrections in gravity work. Research in analytical chemistry has developed a method for separating tantalum and niobium from rocks.

The laboratory at Kilauea volcano was completed, and on-the-site studies of the geochemistry of volcanism will soon begin. A study of isotopic variations of lead in nature which may offer a unique approach to reading the historical record of virtually all geologic materials was continued.

National Water Resource Policy Program

This program, oriented primarily toward procuring geologic data required to support the National Water Resources Policy has resulted in significant additions both to our scientific knowledge and to the solution of allied problems relating to minerals and mineral fuels. Geologic mapping in support of the program was begun in the following five areas where water problems are of growing importance: the Delaware River Basin, the Del Rio area, Texas, the Colorado Mountain Front, the Mogollon Rim, Arizona and the Snake River

Plains, Idaho. By the end of the year the field and photogeologic mapping of six 7½-minute quadrangles had been completed and work has been started on 10 additional quadrangles.

Military Geology

Reports on the suitability of rocks, soils, vegetation, and water resources for construction materials and other engineering use were prepared on foreign and domestic areas for the Corps of Engineers, United States Army, and other agencies of the Armed Forces. During the fiscal year, 54 such reports were prepared including one report on the Monterey and Estero Bays area in California and field work was nearly completed for the West Point area. Numerous advisory services were also provided military personnel on the military aspects of the geology of foreign, territorial, and domestic areas. Technical assistance to the Corps of Engineers in Germany and Japan was continued.

In the Pacific, military geology reports for Okinawa and Palau were published and preparation for publication continued on reports for six other islands. Aid was given to the United States Trust Territory, Pacific Islands, on assessment of typhoon damage on Jaluit Atoll, Marshall Islands.

Field surveys of geologic and associated terrain and permafrost conditions in Alaska continued with reconnaissance of the Copper River Basin and field checks of critical localities in the Cook Inlet Region. Comprehensive military and scientific reports were in preparation on 10 areas. Manuscript reports on 11 areas were completed. A terrain study of Big Delta was completed and transmitted to Corps of Engineers, United States Army. The Survey, in cooperation with the permafrost program of the Cambridge Research Center, United States Air Force, and with the glaciological program of the International Geophysical Year, began studies along the Arctic Coast near Barter Island and in the adjoining mountain area. Work continued on compilation of the glacial and surficial deposits maps of Alaska.

In addition to furnishing advice and studies to the Corps of Engineers, field studies were made in the Arctic, primarily Greenland, for the Air Force.

Foreign Geology

Dissemination of knowledge of geologic processes and the sharing of geological information, as related to economic mineral investigations, continued during fiscal year 1958, between Survey and counterpart Government agencies in 17 countries under the auspices of the International Cooperation Administration. Emphasis was placed on



United States Geological Survey field party working in cooperation with geologists of the Pakistan Geological Survey in a search for economic mineral deposits.

ing cooperating governments to establish or strengthen Government scientific agencies in order to develop their mineral resources by applying modern geologic methods.

On-the-job advice, including consultation and training in investigation methods and techniques, were continued to counterpart scientific agencies in Brazil, Chile, Peru, Mexico, Saudi Arabia, Iran, India, Thailand, Formosa, Indonesia, Pakistan and the Philippines. Short term advisory services on specific problems were furnished to Afghanistan, Turkey, Korea, and Ghana. Major education programs were initiated in Brazil and Chile.

Seventy-two participants from 24 countries, under sponsorship of International Cooperation Administration, the Atomic Energy Commission, and the Eisenhower Fellowship Program-United Nations, received training in the Survey's domestic program, workshops members of Survey field parties and laboratory groups. This training was supplemented in many instances with specialized grad-

uate work at American universities. Specialized training facilities in photogeology were established.

Concurrently, Survey scientific personnel abroad extended training to more than 300 nationals of countries in which continuing long-term studies are being conducted.

To date, 61 bulletins and professional papers have been published, co-authored with geologists abroad, giving the results of cooperative field studies and containing bilingual, multicolored geologic maps. They have stimulated the development of the mineral deposits surveys and scientific reporting within the host countries.

Library

The 1955 volume of the Bibliography of North American Geology has been published and the 1956 volume is in press.

There was an increase in the number of purchased and exchanged books from Russia which has done much to fill a very serious gap in the Geological Survey libraries. Experimentally, part of the duties of one librarian at Denver has been used to review Russian material and to abstract, summarize, and translate the material required to meet the requests of Geological Survey personnel. Additional space was made available for the Denver library to provide better accommodations for the map and well-log collections.

Library use and activity in the Geological Survey Library at Washington and its branches in Denver and Menlo Park are summarized as follows:

| Activity | Washington | Denver | Menlo Park |
|---|------------|--------|------------|
| Text accessions..... | 22,727 | 19,043 | |
| Map accessions..... | 2,817 | 1,551 | |
| Loans for use outside of library..... | 48,384 | 11,929 | |
| Loans to other libraries..... | 5,822 | 624 | |
| Items borrowed from other libraries..... | 4,656 | 2,504 | |
| Readers and users of books and maps within library..... | 27,336 | 22,970 | |
| Well-logs loaned for use outside library..... | | 1,429 | |

WATER RESOURCES DIVISION

The tremendous past and prospective growth of the Nation has sharpened the focus of attention on water problems of the country, as well as those of local areas. The Water Resources Division is responsible for determining, appraising, and describing the surface and underground water resources to aid the solution of water problems of the United States.

Water resources investigations include the systematic collection, analysis, interpretation, and publication of hydrologic and geologic data; appraisal of water resources of specific areas; stu-

er requirements for industrial, domestic, and agricultural uses; research and development to improve techniques and the scientific basis of investigation.

ix circulars, a bulletin, one professional paper and 63 water supply ers were published in the Division during the past fiscal year in Survey's regular series of publications. In addition, 57 reports placed in open files, and 265 manuscripts were printed in scientific journals.

Three sources of funds are available for financing water-resources stigations:

Direct appropriations.

Funds provided by States and municipalities, to be matched by eral funds, for investigations having mutual interest.

Funds transferred from other Federal agencies for work to be at their request.

Federal-State cooperative investigations began in 1895 and this gram has grown steadily, now constituting about 60 percent of the program of the Division. Funds made available by States and icipalities in 1958 for cooperative studies are shown in the following table:

and Municipal Offering for Cooperative Water Resources Investigations

| te | 1958 | State | 1958 |
|-----------|-----------|----------------|-----------|
| ma | \$165,852 | Nevada | \$43,696 |
| ca | 2,800 | New Hampshire | 18,273 |
| na | 139,986 | New Jersey | 136,625 |
| ansas | 66,505 | New Mexico | 221,922 |
| ornia | 536,955 | New York | 318,764 |
| ado | 143,146 | North Carolina | 153,970 |
| ecticut | 46,372 | North Dakota | 45,297 |
| avare | 48,234 | Ohio | 159,575 |
| da | 264,258 | Oklahoma | 106,849 |
| ia | 134,795 | Oregon | 87,367 |
| i | 12,302 | Pennsylvania | 194,460 |
| ail | 159,959 | Puerto Rico | 24,586 |
| o | 62,928 | Rhode Island | 25,991 |
| is | 78,721 | Samoa | 3,487 |
| na | 167,950 | South Carolina | 24,063 |
| | 81,394 | South Dakota | 33,379 |
| as | 110,909 | Tennessee | 99,353 |
| ucky | 144,995 | Texas | 393,304 |
| iana | 195,363 | Utah | 152,082 |
| e | 14,032 | Vermont | 11,557 |
| land | 63,115 | Virgin Islands | 3,203 |
| achusetts | 73,938 | Virginia | 18,100 |
| igan | 96,251 | Washington | 152,003 |
| esota | 128,084 | West Virginia | 43,438 |
| ssippi | 64,614 | Wisconsin | 76,926 |
| uri | 45,062 | Wyoming | 85,296 |
| ana | 55,753 | | |
| aska | 91,627 | Total | 5,829,916 |

Surface Water Investigations

Streamflow and other surface-water data were obtained at 71 sites in the 48 States and in Alaska, Hawaii, Guam, and Puerto Rico during fiscal year 1958. These include data collected for the Survey's own needs as well as in cooperation with 205 State and municipal agencies, and for other Federal agencies such as the Corps of Engineers, Bureau of Reclamation, Tennessee Valley Authority, State Department, Soil Conservation Service, Atomic Energy Commission, and permittees and licensees of the Federal Power Commission. A nationwide review and appraisal has been made of the gaging-station network, and the results of the review are being used for program planning purposes.

Compilation of all streamflow records in the United States for the period 1888-1950, a project which was started in 1951, is 89 per cent complete. During the year the reports for the Ohio and Mississippi River basins and for Alaska were published. These reports summarize in a single volume the historical and long-term record of monthly and annual discharge by streams that formerly were contained in nearly 50 volumes of an annual report series.

Flood-frequency analyses for New England and for the Colorado River basin, part of a nationwide study of regional flood frequencies, were virtually completed for publication. Pending completion of the nationwide study, preliminary statewide analyses are being made in cooperation with several State agencies. Analyses were completed and reports were released to the open files for Kentucky and eastern Montana; reports for Ohio, Indiana, Tennessee, and Wisconsin near completion.

Five flood reports were published as water-supply papers. They are:

- Floods of April-June 1952 in Utah and Nevada
- Floods of May-June 1953 in Missouri River Basin in Montana
- Summary of Floods in United States during 1951
- Floods of 1950-51 in Catskill Mountain Region, New York
- Floods of June 1954 in Iowa

Several reports on local floods were released to the open files. A report on the hydrologic and hydraulic aspects of flood-plain zoning, the first of its kind, was prepared in cooperation with the Commonwealth of Pennsylvania and approved for release to the open files pending publication.

Rainfall-runoff studies of maximum annual floods were made for 49 drainage basins, and runoff studies of maximum annual floods were made for about 630 areas, all for drainage areas of less than 400 square miles. The work was done on behalf of the United States Soil Conservation Service.

Hydraulic data for 80 drainage-structure sites were furnished to highway departments in 28 States, as part of programs in cooperation with these agencies.

Low-flow frequency analysis for Iowa and for stations in the Delaware River Basin were completed and are being prepared for publication. Similar analyses are under way in Indiana, Kansas, and North Carolina.

Interstate compacts for the apportionment of interstate waters usually include provisions for measurement of streamflow, commonly by the Geological Survey. Twenty such compacts are in effect and others are under negotiation. Water-resources investigations were continued along the Canadian boundary, as required by the Boundary Water Treaty of January 11, 1909, between the United States and Canada, or by order of the International Joint Commission.

Ground Water Investigations

Need for information about the occurrence, quality, and availability of ground water continues to be urgent. In areas where pumping developments are large, quantitative information is used increasingly to assess the adequacy and permanence of the water supply and to insure against overdevelopment and economic distress.

Ground-water investigations were chiefly areal studies and reports on the ground-water resources of counties and ground-water basins. The activities ranged from basic research on the fundamental principles that govern the occurrence and movement of ground water in various geologic and hydrologic environments, as part of the areal investigations, to systematic inventories of drafts on water supplies and observations of water-level fluctuations. About 600 ground-water investigations were in progress during the year. Four-fifths of these were in financial cooperation with State and local public agencies in 44 States, and the territories of Alaska, Hawaii, Guam, the Virgin Islands, and Puerto Rico. About one-fifth, mainly of national interest and of direct concern to other Federal agencies, were financed wholly from Federal funds.

Results of investigations were made available to the public in 127 published reports and papers and in 160 reports released to the open pending publication. The published reports include 33 water-supply papers, 1 professional paper, 1 hydrologic atlas, 1 circular, 35 reports published by cooperating agencies, 28 papers in scientific journals, and 28 in duplicated form. Forty-six additional reports were released for administrative use by other Federal agencies.

According to many of the reports covering drainage basins, quadrangles, counties, and other subdivisions of States throughout the country there are adequate supplies of ground water of good quality for

most private, industrial, and municipal needs. However, in some areas the supplies are less plentiful or their chemical quality is poor. In some coastal areas development of ground water is hampered by potential landward encroachment of salt water in permeable water-bearing formations. Study of this problem is continuing.

In the interest of conserving water to meet ever-growing demand and to reduce flood hazards in the West, Survey scientists are studying the problem of phreatophytes (water-loving plants) that grow in many western stream valleys. In addition to wasting large quantities of water, these plants develop a junglelike growth that invades and chokes the normal overflow channels of streams so that floodwaters back up and spread out on the adjacent farmland. Water-Supply Paper 1423 catalogues different types of phreatophytes and estimates amounts of water consumed in various areas by these plants.

Chemical Quality of Water Investigations

Investigations of the chemical characteristics of water supplies throughout the Nation were continued in 1958. Many studies were broadened to give a fuller description and explanation of the occurrence and movement of dissolved minerals in natural surface waters and ground waters as an aid to optimum use and development. In addition to supplementing the nationwide programs, more intensive chemical quality investigations were in progress in the basins of the Colorado, Missouri, Pecos, Columbia, and Yadkin-Pee Dee Rivers, and in Alaska. Also, investigations in some 20 States and local areas were made in cooperation with Federal, State, and municipal agencies.

The investigations included systematic collection of data on the chemical quality of water at about 550 stream locations. Reconnaissance surveys involving infrequent sampling of streams were undertaken in several areas to delineate quality characteristics in specific watersheds. Appraisal of the chemical quality of underground water supplies was included as part of the ground-water investigations in many areas. Substantial progress was made in 1958 to establish criteria for the development of a nationwide network of water quality stations.

In 1958, the Survey began a study of major worldwide contributions of dissolved solids being carried from land surfaces to the oceans. The Survey also began a study of the significance and potential use of tritium as a tracer and age determinant in water investigations.

Reports of special interest that were published or released during 1958 include those on uranium and radium in ground waters of the Llano Estacado, Texas, and New Mexico; Quality of Surface Waters

irrigation in the Western United States in 1954; Chemical Character of Public Water Supplies in Alaska, Hawaii, and Puerto Rico; Chemistry of Iron in Natural Waters; The Study and Interpretation of Water Analyses; Hydrologic and Tracer Studies in Mohawk River at Knolls Atomic Power Laboratory; Saline Water Resources in North Dakota; and Quantity and Quality of Surface Waters of Texas Through September 1950. Reports describing the chemical character of the surface waters of Texas, Oklahoma, North Carolina, Kansas, Kentucky, Pennsylvania, and New York were prepared in cooperation with those States.

Temperature variations in water are important to industry, to fish life, and to public water works. Daily, weekly, or monthly observations of temperature of water at more than 600 locations on rivers were obtained. Continuous recordings were made of the temperature of streams at about 90 locations.

Sediment Investigations

The Survey continued to investigate the quantity, movement, and uses of water-borne sediments, in order to evaluate effects of sediment on reservoir storage, navigability of waterways, diversion works, irrigation canals, and water-supply systems. Comprehensive sediment studies were undertaken in the Missouri, Colorado, and Middle Rio Grande Basins. The programs included measurement and analysis of sediment movement and deposition, and determination of contributing sources and other pertinent facts which are important to extensive Federal programs of water use in these areas. Investigations in cooperation with State and local agencies were in progress in eight States to measure and explain changes in runoff and sediment discharge that are associated with changing patterns of land use. The sediment transported by streams at about 220 sites throughout the country was measured.

Studies were made in collaboration with the Soil Conservation Service on the sediment yields and trap efficiency of reservoirs in small watersheds in eight States. Special intensive sediment studies were made for the Bureau of Reclamation in the Rio Grande and Colorado River Basins and for the Soil Conservation Service in the Medicine River watershed of Nebraska.

Reports of special importance that were published or released during 1958 included: Investigations of Sediment Transportation in Middle River, Nebraska; Trends in Sediment Discharge of Brandywine Creek, Delaware; Erosion and Deposition in Stock Reservoirs in Lower River Basin, Wyoming; Relation of Sediment Discharge to Stream Flow; and Origin of Steps on Loess-Mantled Slopes.

Special Investigations

A comprehensive study of the hydrology of the Colorado River Basin above Lees Ferry, Ariz., was begun during the year and scheduled for completion during fiscal year 1961. All aspects of the occurrence, use, and availability of water are being studied, with special emphasis on chemical quality and the interrelationships between surface-water and ground-water supplies. A similar study of the Tularum River Basin, which was begun during fiscal 1957, is scheduled for completion during fiscal 1959. This study is being made partly to meet the needs of the Corps of Engineers in preparing a comprehensive plan of development for the basin.

Studies of water requirements of the copper and petroleum industries were completed during the year and reports are in preparation. Work was started on the requirements of the steel industry and is scheduled for completion during fiscal 1959.

Summary studies of the water resources of the Los Angeles, California; Syracuse, N. Y., and Springfield, Mass., areas were started during the year. Reports on the Neuse River and Yadkin-Pee Dee River Basins of North Carolina, were published. A report on studies of water loss by evaporation from Lake Mead was published as Professional Paper 298.

The Survey started work on a series of publications which will summarize knowledge about the water resources of each State. Reports on the general hydrology and water resources of Arizona, Oklahoma, Georgia, Oregon, and Rhode Island were started during the year. Others are scheduled.

Soil and Moisture Conservation

The Geological Survey continued to investigate the hydrologic and geologic conditions on public lands to provide data needed by Interior Department agencies for the wise and efficient use and management of those lands. Investigations were made of water supply in grazing areas in Utah, Nevada, Idaho, and California. Data on runoff and sediment yields were collected for reservoirs constructed as part of the conservation program on public lands in Montana, Wyoming, Colorado, Utah, New Mexico, and Arizona. A project was continued in the Cheyenne River Basin to evaluate the effect of water spreading on the water yield of the basin and on the movement of sediment.

Research and Development

Most great strides in human progress have followed on the heels of research and development activities. Without research and development

ment in the water-resource field, there is little possibility that the Nation can make the most effective use of its water. Thus, research is an essential element of the Survey's program of water resources investigations. This research is aimed directly at subjects and areas about which knowledge is inadequate and in which improved understanding is needed of the principles and laws which govern hydrologic systems. Research is now in progress to disclose new principles, to refine those already known, and to develop new methods and equipment for investigating the Nation's water resources.

As in other branches of research, hydrologic research cannot be gauged to specific annual accomplishments. Space in this report does not permit description of all the important research and development work carried on in 1958, but the following selected items indicate the kinds of inquiries that are in progress:

a) The nature of water movement through porous material, like sand, leading to better understanding of ground-water movement in certain kinds of earth materials.

Hydraulic engineers of the Federal Geological Survey at the Hydrologic Experimental Laboratory, Fort Collins (Colorado State University) are using an outdoor tank to calibrate a flow meter.



(b) Mechanism and extent of salt-water encroachment and contamination of fresh water aquifers and streams in areas where excessive pumping of ground water, diversion of surface water, or other factors change the hydraulic balance between the ocean and inland waters.

(c) Physical behavior of water and sediment in laboratory flumes including observations to improve mathematical formulas describing flow conditions.

(d) The chemical form and source of iron dissolved in natural water, small amounts of which materially affect the usefulness of water for public supply and industrial processes.

(e) Effects of land management and other conservation practices on the quantity and quality of water within the downstream flood treated areas.

(f) Waterflow near mouths of rivers where ocean tides cause a reversal in direction of flow.

(g) Evaporation suppression and the effectiveness of a thin surface film of chemicals, like hexadecanol, to reduce losses of water by evaporation from lakes and reservoirs.

Technical Assistance Program

Long-term projects were being carried on in 8 foreign countries by the end of the fiscal year, including 6 ground-water and 2 surface water studies. The projects generally combine the training of a nucleus of native personnel in the methods and techniques of water resources investigations with investigations of specific areas for which development has been proposed. At the end of the year more than 100 foreign nationals were receiving in-country training by United States personnel on field projects in Afghanistan, Chile, India, Iran, Italy, Pakistan, Peru, and the Philippines. The task of compiling the results of 5 years of geologic mapping and field reconnaissance in Saudi Arabia was continued in Washington, with the completion of the 1:200,000,000 geographic map of the Arabian Peninsula in Arabic and English editions separately. This map is the base for a geological edition now in preliminary preparation.

Experts on water resources were assigned to British Guiana, Cambodia, and Turkey for a period of 3 months each. Also, an expert on ground-water resources was temporarily assigned to the United States Army Engineer District, Far East, at Pakistan to supervise a ground-water investigation.

During the year, citizens of Afghanistan, Chile, Colombia, Greece, India, Pakistan, Philippines, Taiwan, Tanganyika, Turkey, and Yugoslavia received training in the United States.

TOPOGRAPHIC DIVISION

The Topographic Division prepares and maintains the National Topographic Map Series covering the United States, its Territories and Possessions. This involves operations and research in five major work phases: aerial photography, geodetic control, photogrammetric and field compilation, cartography and editing, and printing. Related activities include the preparation of special maps and supplying Federal agencies and the general public with advance map materials, aerial photography, geodetic control lists, and map information.

In addition, the Topographic Division, through the International Cooperation Administration, extends technical assistance to accredited representatives of other nations. During fiscal year 1958, extended periods of technical training were provided to three civil engineers from Iceland, and briefer courses to cartographers from Spain and Brazil, and a photogrammetrist from Thailand. Tours of Division mapping facilities or discussions of its activities and techniques were arranged for about 70 foreign visitors.

Representatives of the Division participated in the International Photogrammetric Conference on Aerial Triangulation, held at Ottawa, Canada, in August; in the regional seminar on Topographic Mapping for Economic Development, held at Teheran, Iran, in October; in the First Symposium on Natural Resources in Cuba and in the VIII Consultation on Cartography of the Pan American Institute of Geography and History, both held at Havana, Cuba, in February; and the United States-Canada Mapping, Charting, and Aerial Photography annual meeting, held at Ottawa, Canada, in May.

The Geological Survey undertook to assemble the report on cartographic activities in the United States Government for the period July 1, 1954, to June 30, 1957. This report was printed in both English and Spanish editions and submitted for the VIII Consultation on Cartography of the Pan American Institute of Geography and History.

Important changes were made in the organization of the Topographic Division during the year. With the release by the Civil Service Commission on November 25 of an "approved introduction to the position-classification standards for the Cartography Series," the Division was enabled to proceed immediately with its plan for conversion to an engineer-technician form of organization. Subsequently, a reorganization of the Washington staff was effected with establishment of the Office of Program Development and the Office of Research and Technical Standards, each headed by an Assistant Chief Topographic Engineer.

To provide adequate personnel to staff the engineering positions required for supervision, management, planning, research, and admini-



Survey Topographic engineers conducting transit traverse mapping operation near Lee Vining, Calif.

istration, the Topographic Division has developed for its employees a Student Training Program for engineering students, and a Career Development Program for graduate Civil Engineers.

During the year, more than 1,600 new topographic maps were published. Mapping projects were under way in every State, the District of Columbia, Alaska, the Hawaiian Islands, Puerto Rico, and the Virgin Islands. More than 20,000 topographic maps are now published and distributed by the Geological Survey.

In fiscal year 1958, a policy decision was made which fundamentally affects the mapping program. In the future, all map manuscripts excluding Alaska, will be prepared under the specifications for 1:100,000 scale maps. Although the first publication of the new maps will sometimes be at 1:62,500 scale, the manuscripts will be available for future publication at 1:24,000 and will also be on open file for interested map users.

Fiscal year 1958 marked the termination of a long-standing program of aeronautical chart compilation undertaken for the Air Force by the Special Maps Branch. Reorganization of the Special Maps Branch and reorientation of its program are now being studied.

The Chief Topographic Engineer continued as Chairman of the Technical Advisory Committee on Antarctic Mapping. Several meetings were held during the year to study the technical aspects of mapping on that Continent. One engineer spent about 4 months

the participating in a scientific expedition to test the application of a specific electronic device for the establishment of mapping control points. Assistance was also given to IGY representatives seeking information on aerial photography and geodetic control in Antarctica. A contract was signed to construct a new building at the Geological Survey center in Menlo Park, Calif., to house Pacific Coast area employees and mapping facilities of the Topographic Division.

Mapping Programs and Map Production

Within the continental United States, nearly 1,500 permanently marked triangulation stations were established to provide control for areas totaling more than 58,000 square miles. About 7,300 linear miles of transit traverse and about 14,300 linear miles of leveling were run, with permanent marks established at intervals of 2 to 3 miles. The computed results of these surveys are made available, on request, to other Government agencies and to the public.

Contracts were let for 105,728 square miles of precision aerial photography for topographic mapping purposes. The Air Force delivered aerial photographs covering 13,900 square miles for use in compiling topographic maps required by the Department of Defense. During the year, 2,898 maps were sent to the Publications Office for printing and distribution. New 1:500,000 scale State maps of Colorado, Kentucky, North Carolina, and Virginia were printed. Compilation is in progress for the new State maps of Maine, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Tennessee, Texas, Utah, and Washington.

Of the 2,898 completed maps sent for reproduction, 1,182 were new standard topographic quadrangles prepared by the Geological Survey and 49 were new maps compiled by other civil agencies but published and distributed by the Geological Survey in accordance with its responsibilities. Also included were 227 Geological Survey revisions, reprints of existing maps, 32 one-color advance editions, and 68 index maps. In addition, there were 359 civil editions of maps which had been prepared by the Department of Defense for military and 15 miscellaneous maps prepared for research, administrative, or informational purposes.

The accelerated program to prepare urban area maps for civil defense purposes continued. Standard urban area maps for 12 cities were printed, 1 was ready for reproduction, and 5 are in progress.

An agreement with the Chief of Engineers, Department of the Army, was signed whereby the Geological Survey, in keeping with responsibility for domestic mapping, will undertake the maintenance of the United States 1:250,000 scale map series, prepared originally by the Army Map Service.

Forty-five special-use maps were completed for the other Divisions of the Geological Survey, the Army Map Service, the Atomic Energy Commission, Interstate Commerce Commission, Justice Department, and the Bureau of Reclamation.

A cooperative project with the Bureau of Land Management was undertaken whereby the Geological Survey supplied photogrammetric assistance in the cadastral survey of 10 townships in Utah. The photogrammetric procedure enabled the cadastral surveyor to locate the township exteriors and corners of the four school sections in each township without having to survey the land net in the conventional manner.

During fiscal year 1958, cooperative programs were in effect in 20 States, Puerto Rico, and the Virgin Islands. The States of Arkansas, Kansas, Minnesota, and Ohio made substantial increases in their contributions, and the States of Florida, Oregon, and Texas began new programs. Total cooperative offerings during the year amounted to about \$1,700,000.

A detailed summary of map production is shown in the following table:

Areas (in square miles) mapped or revised during fiscal year 1958 for publication on standard scales

[Contour intervals, 5 to 100 feet]

| State | New mapping area mapped, scale | | Area revised | Total |
|----------------------|--------------------------------|----------|--------------|-------|
| | 1:24,000 | 1:62,500 | | |
| Alabama | 1,223 | 558 | | 1,781 |
| Arizona | 1,309 | 4,328 | 2,538 | 8,175 |
| Arkansas | 4,042 | | | 4,042 |
| California | 1,399 | 5,560 | 2,277 | 9,236 |
| Colorado | 1,874 | 1,421 | | 3,295 |
| Connecticut | 3 | | 414 | 417 |
| Delaware | | | 20 | 20 |
| District of Columbia | | | | |
| Florida | 3,054 | | | 3,054 |
| Georgia | 419 | 1,424 | | 1,843 |
| Idaho | 1,577 | 6,728 | 217 | 8,522 |
| Illinois | 39 | 447 | 31 | 517 |
| Indiana | 3,297 | | 784 | 4,081 |
| Iowa | 377 | | | 377 |
| Kansas | 1,060 | | 20 | 1,080 |
| Kentucky | | | 313 | 313 |
| Louisiana | 24 | 2,230 | 250 | 2,504 |
| Maine | | 676 | 3,480 | 4,156 |
| Maryland | 3 | | 382 | 385 |
| Massachusetts | | | 657 | 657 |
| Michigan | 249 | 4,103 | | 4,352 |
| Minnesota | 370 | 2,659 | 51 | 3,080 |
| Mississippi | 251 | 586 | | 837 |
| Missouri | 522 | | 111 | 633 |
| Montana | 210 | 620 | | 830 |
| Nebraska | 753 | | | 753 |
| Nevada | 515 | 4,339 | | 4,854 |
| New Hampshire | | | 1,536 | 1,536 |
| New Jersey | 79 | | 3 | 82 |
| New Mexico | 831 | 134 | | 965 |
| New York | 753 | 410 | 617 | 1,780 |
| North Carolina | | 521 | | 521 |
| North Dakota | 1,236 | | | 1,236 |
| Ohio | 909 | | 1 | 910 |

Areas (in square miles) mapped or revised during fiscal year 1958 for publication on standard scales—Continued

| State | New mapping area mapped, scale | | Area revised | Total |
|----------------------|--------------------------------|----------|--------------|---------|
| | 1:24,000 | 1:62,500 | | |
| Alabama | 1,240 | 937 | | 2,177 |
| Alaska | | 3,047 | 181 | 3,231 |
| Arizona | 1,138 | | 708 | 1,846 |
| Arkansas | | | 137 | 137 |
| California | 724 | 224 | 388 | 1,340 |
| Colorado | 1,705 | 84 | | 1,789 |
| Connecticut | 961 | | 210 | 1,171 |
| Delaware | 1,900 | 6,691 | | 8,591 |
| District of Columbia | 58 | 779 | 579 | 1,416 |
| Florida | | 133 | 430 | 563 |
| Georgia | 3 | 1,865 | 236 | 2,104 |
| Hawaii | 162 | 4,661 | 139 | 4,962 |
| Idaho | 2,096 | | | 2,096 |
| Illinois | 84 | 305 | | 389 |
| Indiana | 104 | 3,230 | 861 | 4,195 |
| Iowa | | | | |
| Kansas | 36,553 | 58,649 | 17,607 | 112,809 |
| Kentucky | | 31,970 | | 31,970 |
| Louisiana | 237 | | | 237 |
| Maine | | | 1,349 | 1,349 |
| Marshall Islands | 100 | | | 100 |
| Maryland | | | | |
| Massachusetts | | | | |
| Michigan | | | | |
| Minnesota | | | | |
| Mississippi | | | | |
| Missouri | | | | |
| Montana | | | | |
| Nebraska | | | | |
| Nevada | | | | |
| New Hampshire | | | | |
| New Jersey | | | | |
| New Mexico | | | | |
| New York | | | | |
| North Carolina | | | | |
| North Dakota | | | | |
| Ohio | | | | |
| Oklahoma | | | | |
| Oregon | | | | |
| Pennsylvania | | | | |
| Rhode Island | | | | |
| South Carolina | | | | |
| South Dakota | | | | |
| Tennessee | | | | |
| Texas | | | | |
| Utah | | | | |
| Vermont | | | | |
| Virginia | | | | |
| Washington | | | | |
| West Virginia | | | | |
| Wisconsin | | | | |
| Wyoming | | | | |
| Total | 36,890 | 90,619 | 18,956 | 146,465 |

33,360.
In addition, 98,435 square miles were mapped at 1:250,000 scale.
20,000.

Research and Development

Research and development in instruments, methods, and procedures continued in all phases of map preparation in an effort to increase efficiency and reduce costs.

During the year, the Division trained engineers from each of the field areas to operate the newly acquired electronic distance-measuring equipment. This equipment measures distances with an accuracy hitherto unattainable at reasonable cost.

An improved model of the elevation meter was successfully tested on a project in Georgia. This electromechanical device is mounted in a four-wheel-drive, four-wheel-steer carryall and computes differences in elevation continuously as the vehicle is driven from point to point. The meter has been obtained, on a rental basis, for use on supplemental control projects.

Precise leveling rods of a new design were put into production. The new design consists of an extruded magnesium-alloy body, laminated plastic facings on which the coarse graduations are engraved, and a center strip of invar containing the fine graduations.

Other improvements in field-survey equipment and techniques included:

1. The conversion of a total of 120 standard alidades to self-indexing operation.

2. Adoption of a new standard design for alidade reticles which minimizes the possibility of misreading.

3. Stadia-rod facings printed on scale-table plastic.

4. A battery-powered electric drill for drilling holes in rock, masonry, or concrete, in which control-survey tablets can be set.

5. Use of ground paneling and 35-mm. photography from light aircraft to photoidentify control points in areas where normal photoidentification techniques are unsatisfactory.

The Geological Survey's electronic digital computer is being used to convert geodetic control from geographic to plane coordinates on a production basis. The problem of analytical aerotriangulation by the direct geodetic restraint method is being studied and will be programmed for the computer.

A new type of automatic-dodging contact printer, which uses the principle of quenching ultraviolet light with infrared light, was procured and tested. Subsequently, a contract was let to apply the same principle to projection printers, and new specifications were written that require commercial contractors to use automatic-dodging printers in making prints to be delivered under future aerial photography contracts.

Other research in aerial photography included:

(a) A study of the effects of flight height, camera focal length, and 20-degree obliquity on the usable imagery of aerial photographs.

(b) An analytical study of the effect of sun angle on the imagery of aerial photographs taken at all latitudes in the United States, to provide a basis for limiting the times at which photographs may be taken under future contracts.

(c) An investigation of possible applications of infrared and color photographs in mapping operations.

The prototype orthophotoscope, an instrument for producing equivalent orthographic prints from stereoscopic pairs of conventional perspective aerial photographs, was redesigned. Specifications are being written to procure several instruments of the new design. Orthophotographic mosaics are being tested in the field to determine their value in topographic mapping.

Other photogrammetric developments included:

(a) A system of contouring scale models that represent the photogrammetric characteristics of drainage areas.

(b) A project, in cooperation with the Lincoln Laboratory of the Massachusetts Institute of Technology, to test the accuracy of the Lincoln Raydist system for determining the space positions of aerial camera exposure stations. A report on the results of this test is expected early in fiscal year 1959.

(c) Use of new diapositive plates of extreme flatness.

Research in map-finishing operations has been directed toward the improvement of scribing instruments, materials, and procedures and toward increased use of photomechanical processes. The feasibility of producing both 7 1/2-minute and 15-minute maps from the same color-reproduction materials is being investigated. New symbolization has been developed for a more accurate and detailed representation of wetland features, and the possibilities of representing roads by single-line symbols are being investigated.

Map Information

Facilities for supplying information on maps, aerial photography, and geodetic control surveys to Federal, State, and local government agencies, and the public, are maintained at the Map Information Office in Washington and at the Division's field offices. Services include walk-in-the-counter map sales for the convenience of the public, commercial firms, and Government agencies, and assembly of special maps, topographic and geodetic control data to meet the requirements of the Geological Survey and other Federal agencies. A new policy of making a nominal charge for geodetic control lists was started during the year.

The eighth edition of the index *Status of Topographic Mapping in the United States* (two sheets) and the ninth edition of the index *Status of Aerial Photography in the United States* were published, and both on the National Atlas format. The sixth edition of the index *Status of Aerial Mosaics in the United States* was prepared and will be published as part of the National Atlas.

Revised editions of the military indexes to Alaska mapping photography, taken through the combined efforts of the U. S. Navy, U. S. Air Force, and the Geological Survey from 1948 to 1957, were reproduced and made available to other agencies and the public. An unprecedented volume of orders for Alaskan aerial photography was received from photogeologic firms and the petroleum industry for use in oil exploration in the Territory.

The Map Information Office continued to serve as the central depository for the maps which make up the National Atlas of the United States. A Tennessee River hydrographic chart and 282 agricultural maps (contained on 41 Atlas sheets) were received from Federal agencies during the year. The several hundred inquiries concerning the Atlas reflected increased interest among libraries, universities, research organizations, and Government agencies in the United States and several foreign countries.

CONSERVATION DIVISION

The Conservation Division classifies Federal lands as to mineral and water resource values and supervises mineral-recovery under leases, permits, and licenses on Federal, Indian, and Naval petroleum reserve lands. In February the responsibility for supervising administration of the Connally Oil Act was transferred to the Survey.

A small headquarters staff and a field staff of competent geologists and engineers are employed. This force makes field surveys, prepares maps and reports dealing with water power, fuels, minerals, and chemicals essential to the mineral-resource economy of the United States, and conducts on-site supervision of mining and drilling operations necessary to assure the safe and economical production by private enterprise of coal, oil, gas, and other minerals.

Mineral Classification

Geologists from field offices in Alaska, California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming, made special investigations which have resulted in geologic reports and maps for official use by all branches of the Conservation Division, Geological Division, and by other bureaus of the Interior Department. During the fiscal year 1958 maps and reports were completed on the Spotted Kane area, Wyoming; North Fork oil field, Wyoming; Iron Creek Poison Spider area, Wyoming; Bar-X and adjacent gas fields, Utah and Colorado; Nucla-Naturita area, Colorado; Red Wash-Water Hollow oil field, Utah; reconnaissance of phosphate in northeastern Nevada, northwestern Utah, and southern Idaho; Flathead River power site investigations, Montana; northwestern Oregon power site investigations; Alaskan sedimentary basin classification; and Arizona oil and gas map.

Increased workload has necessitated the opening of two new regional offices at Farmington, N. Mex., and Carlsbad, N. Mex.

A total of 30,144 cases were processed which included 5,998 cases involving the outright disposal of Federal lands, either with the reservation of minerals or with the reservation of one or more specified minerals, and 24,146 cases involving the Government's right under Federal leasing laws to lease a mineral substance from lands under its jurisdiction. This was a decrease of 2,782 over the number of similar cases for the previous year. In addition initial or revised definitions of 45 producing oil and gas fields containing Federal lands were promulgated; 263 unit-plan and participating-area proposals were appraised geologically; 34 determinations of the productive limits of producing oil and gas deposits as found to exist on Aug-

1946, were made; geologic significance of 200 new discoveries of oil or gas made on or affecting Federal-land leaseholds were reported; appropriate action; the competitive sale of oil and gas leases on parcels of public land were recommended; 47 appeals from decisions of the Bureau of Land Management affecting the disposal of Federal lands were reviewed; and 94 miscellaneous reports on the mineral potentialities of specific lands for various agencies of the Federal Government were prepared.

Water and Power

Engineers and geologists conducted investigations to determine waterpower and storage possibilities of streams and lakes on public lands and classified them accordingly. These duties are carried out from a central office in Washington, D. C., and four field offices located in Denver, Colo.; Sacramento, Calif.; Portland, Oreg.; and Tacoma, Wash. Investigatory work in Alaska is supervised from the Tacoma, Wash., office. Field work during 1958 was directed mainly toward obtaining basic information on the waterpower resources and storage possibilities of Federal lands in Alaska, California, Idaho, Montana, Oregon, and Washington. Field projects completed during the year (some of which were continued from the previous year), or in progress as of June 30, include surveys on the White Salmon, Klickitat, and Wind Rivers, Wash.; Clark Fork River, Mont.; Lemhi River, Idaho; DeWaters, Imnaha, Nehalem, Yaquina, and Silvies Rivers, Oreg.; Stanislaus, Kern, and Eel Rivers, and Cache Creek, Calif.; and Takatz, Snysku, Deer, and Silver Lakes, Chatanika and Lowe Rivers, and Sweetheart Creek, Alaska.

The foregoing projects include a total of 480 miles of stream channel surveys and 51 dam site surveys. For the current year the work completed would be the equivalent of about 250 miles of channel surveys and 35 dam site surveys.

As of June 30, maps for about 340 miles of stream topography and dam sites were in various stages of preparation for publication. Maps published during the year covered 106 miles of streams and 4 dam sites. Maps completed and awaiting publication cover 107 miles of streams and 11 dam sites.

During the year one report was published as a circular and one report was approved for publication in the Transactions of the International Union of Geodesy and Geophysics. In keeping with the program of making a systematic review of waterpower withdrawals 10 reports were prepared which resulted in recommendations for the right restoration of 25,000 acres, and the restoration under the provisions of section 24 of the Federal Power Act of 32,000 acres of

previously withdrawn lands. Seventy-five reports relating to water resources by other agencies were reviewed in the Washington office.

Classification activities resulted in the addition of 159,653 acres to power site reserves and the elimination of 82,544 acres. The outstanding reserves in 23 States and Alaska show a net total of 7,205,143 acres. Reservoir site reserves were reduced by 920 acres and now total 133,903 acres. Reports were prepared and submitted to the Bureau of Land Management on 331 cases involving the waterpower value of lands affected in applications for rights-of-way and 5,998 applications for land acquisition. Forty-nine reports on cases affecting power site lands were prepared and submitted to the Federal Power Commission.

Mining Supervision

Supervisory operations were concerned with discovery, development, and production of coal, potassium, sodium, phosphate, and shale from public lands; of sulphur on public lands in Louisiana and New Mexico; of silica sand on certain lands in Nevada withdrawn by Executive Order No. 5105; of gold, silver, and mercury on certain Spanish land grants; of all minerals, except oil and gas, on restricted, allotted, and tribal Indian lands; on "acquired lands" under the Act of August 7, 1947, and provisions of section 402 of the President's Reorganization Plan No. III of 1946; on land in California State Park under the Act of March 3, 1933 (47 Stat. 1487) and on National Forest land in Minnesota under the Act of June 15, 1950 (64 Stat. 311). Outstanding mineral leases and permits on "acquired" and Indian lands and lands subject to the above-mentioned acts involve the exploration for and production of copper, gold, iron, lead, manganese, silver, nickel, titanium, tungsten, uranium, vanadium, zinc, asbestos, bentonite, clay, coal, garnet, gravel, gypsum, feldspar, fluor spar, limestone, mica, phosphate, pumice, quartzite, quartz crystal, sand, silica sand, sulphur, and vermiculite.

Mining supervision includes responsibility for investigating and reporting on applications for leases and prospecting permits; recommending lease terms, enforcing compliance with lease terms and regulations governing the conduct of prospecting, mining, and beneficiation; protecting and conserving the natural resources by preventing waste; determining royalty liability; preparing statements and receiving payment of royalties and rentals.

As of June 30, 1958, there were under supervision 4,007 properties involved in leases, permits, and licenses in 32 States and Alaska of which 2,552 were on public land, 405 on acquired lands, and 1,050 on Indian lands. Annual production from such lands under supervision during the fiscal year is estimated at 20,318,000 tons, valued



Department of the Interior Regional Mining Supervisor and an engineer check loading operations at a potash mine near Carlsbad, N. Mex.

\$2,515,000 with royalties amounting to \$6,755,000. The production of coal from public domain land in the United States and Alaska aggregated 5,276,000 tons, valued at \$31,798,000 with a royalty value of \$667,600. Production of coal in Alaska amounted to 873,500 tons. Potash production amounted to 9,116,000 tons of crude and refined salts valued at \$58,501,000 and royalty value of \$2,403,000 during the fiscal year. The principal source of sodium was Searles Lake, California, accounting for 659,200 tons of the total of 825,800 tons of sodium and associated compounds produced from lands under supervision. Total value and royalty value of sodium were \$21,922,000 and \$33,700 respectively. Phosphate rock and shale production was 2,500 tons—1,119,000 tons from public domain valued at \$3,447,000 with a royalty value of \$247,300; 3,700 tons from acquired lands, and 91,900 tons from Indian lands with a combined total value of \$172,000 and royalty value of \$133,000. Production of lead and zinc concentrates from Indian lands amounted to 12,800 tons valued at \$1,156,000 and royalty value of \$93,200. The output of uranium and vanadium ores from Indian lands was 1,395,000 tons.

valued at \$21,371,000 and royalty value of \$2,365,000. Coal, sand and gravel, and other road surface materials made up the major part of the remainder of the production from Indian lands totaling 588,000 tons valued at \$834,000 and royalty value of \$44,000. Coal, fluorspar, feldspar, zinc, asbestos, bentonite, beryl, phosphate, mica, manganese, quartzite, quartz crystal, stone, and sand and gravel were produced from acquired lands in 13 States to an aggregate of 401,200 tons valued at \$1,961,000 and royalty value of \$57,000.

Oil and Gas Supervision

Operations for the discovery, development, and production of oil, natural gas, and products extracted from natural gas are supervised on Federal, Indian, and certain Naval petroleum reserve lands. These duties were carried out during the year by means of 6 field offices and 21 district offices at 21 separate locations in California, Colorado, Louisiana, Montana, New Mexico, Oklahoma, Wyoming, and Washington, D. C.

On the public lands 119,017 oil and gas properties were under supervision at the end of the fiscal year, aggregating 93,106,468 acres in 24 States and Alaska. Drilling on public lands during the year included the spudding of 1,818 wells and the completion of 1,829 wells, of which 1,243 were productive of oil and gas. In all, 27,223 public land wells, including 15,841 capable of oil or gas production, were under supervision on June 30, 1958. Production was appreciably greater than in 1957, amounting to about 132,585,000 barrels of petroleum; 439,526,535,000 cubic feet of natural gas; and 224,222,000 gallons of gasoline and butane, with a total value of about \$440,648,000 and royalty returns to the United States of about \$53,800,000.

There were 5,418 acquired land leases embracing 4,781,000 acres in 8 States under supervision at the end of the fiscal year. Drilling on acquired lands during the year included the spudding of 62 wells and the completion of 62 wells, 28 of which were productive of oil and gas. In all, 688 acquired land wells, including 279 capable of oil and gas production, were under supervision on June 30. Including compensatory royalty allocated to the Rio Vista gas field, the production from acquired land was about 5,531,000 barrels of petroleum; 21,513,491 cubic feet of natural gas; and 1,803,000 gallons of gasoline and butane with a total value of approximately \$21,548,000 and royalty returns about \$2,715,000.

Operations were supervised on 12,329 leaseholds, embracing 3,982 acres on Indian lands in 19 States. Drilling on Indian lands during the year included the spudding of 813 wells and the completion

wells, of which 634 were productive of oil and gas. In all, 10,135 Indian land wells, including 5,919 capable of oil and gas production, were under supervision on June 30. The total production from Indian lands was valued at \$72,410,000 and revenues from rentals, royalties, and bonuses amounted to about \$44,307,000.

Drilling on military lands during the year included the spudding of 13 wells and the completion of 22 wells, 22 of which were productive of oil and gas. In all, 105 military land wells, including 86 capable of oil and gas production, were under supervision on June 30. Royalty on the production of oil, gas, and liquid petroleum gases from military lands amounted to \$1,221,000 from a gross product value of \$8,676,000. On behalf of the Department of the Navy supervision was continued operations for the production of oil, gas, gasoline, butane, and propane from 17 properties under lease in Naval Petroleum Reserve No. 2 in California. Production from 291 active wells totaled 2,378,000 barrels of petroleum; 3,800,000,000 cubic feet of natural gas, and 400,000 gallons of natural gasoline with a total aggregate value of \$36,000 and a royalty value of \$1,200,000.

On the outer Continental Shelf 199 section 6 leases, originally issued by the States of Louisiana and Texas, aggregating 821,112 acres, and 213 leases issued under section 8 of the outer Continental Shelf Lands Act, aggregating 765,597 acres, were under supervision. At the end of the year a total of 1,205 wells, 681 of which were productive of oil and gas were under supervision. Drilling on the outer shelf involved the spudding of 305 wells and the completion of 355, including 127 producers. The production of petroleum from the outer shelf in 1958 was about 45 percent greater than during 1957 and the production of natural gas was about 7 percent greater than during 1957 with a total product value of \$70,877,546. Revenues received during the year, including royalties and rentals, totaled \$15,824,000.

Activities toward unitization of oil and gas operations involving Federal land were reflected in the approval of 73 new unit plans during the year and the termination of 35 previously approved unit plans, leaving 335 approved plans covering 6,128,109 acres outstanding. On the outer Continental Shelf 2 such plans were approved and 1 was terminated during the year. The total now stands at 13, embracing 1,000 acres. About 49 percent of the petroleum, 27 percent of the natural gas, and 50 percent of the gasoline and butane obtained from Federal lands during the year was produced under approved unit agreements. On Indian lands 11 new units were approved and 2 were terminated, the total number of plans in effect at the end of the year being 39, involving 60,202 acres. There were 101 drilling units, or unitization agreements approved during the year, making a total

of 781 outstanding as of June 30. There were no development contracts approved during the year, but one in Alaska was terminated. The total number of such approved contracts outstanding on June 30 was 7 involving 2,443,568 acres.

Connally Act Administration

The Connally Act of February 22, 1935, supports the conservation activities of the oil producing States by prohibiting interstate shipment of oil produced in violation of certain State oil and gas conservation laws.

The Connally Act is administered by the Federal Petroleum Board, the supervision of which was transferred from the Office of Oil and Gas to the Geological Survey by Departmental Order No. 2828 of February 14, 1958.

The Federal Petroleum Board consists of a chairman and a member in duty status at the headquarters office at Kilgore, Tex. The Member position of the Board has been vacant during the past year. The Chairman and the Member exercise general field supervision and direction of the administration of the Connally Act. In the absence of the Member in matters of unusual interest and importance to the Board, the Alternate Member exercises the same function as the Member.

While the Connally Act is applicable wherever State laws limit the rate of production and prescribe conditions for producing and handling of oil, its chief application is in the States of Texas, Louisiana, and New Mexico, whose regulations prescribed under the act are enforced by the Board. So far as possible with the limited resources at its command, the Board also enforces the provisions of the act in other oil-producing States, particularly in Mississippi, Oklahoma, Arkansas, and Kansas.

Unless special exemptions are made by the Board in writing by notice, all operators producing oil within the designated area are required to maintain daily production records and file monthly production reports of operations on each lease in the oilfield as prescribed in the form applicable to the producer; also transporters and refiners are required to file monthly reports on prescribed forms with the Board at Kilgore, Tex. The designated area consists of 106 counties in the State of Texas, the counties of Lea and Eddy in the State of New Mexico, and the entire State of Louisiana.

From the designated areas the Board regularly received and processed each month approximately 9,589 monthly producer's reports, about 464 monthly pipeline reports, and 71 reports from processing

refiners. These reports covered operations in 3,700 separate oilfields and accounted for approximately 58.7 percent of the entire production in the States of Texas, Louisiana, and New Mexico, which was approximately 3,403,678 barrels daily.

During this fiscal year reports covering oilfield operations increased from 3,422 to 3,700 oilfields, an addition of 278 fields. The reports on producing wells rose from 88,371 to 91,808, an increase of 2,437 wells added to the inspection area in one year.

In this fiscal year, 2,826 leases were inspected, 1,606 leases were issued, and 5 pipelines were checked. To accomplish this, 483 oilfields were visited, and 1,184 interviews were conducted.

There were 15 cases of alleged violation of the Connally Act on the docket of the Federal Petroleum Board when the fiscal year began. Five new investigations were started during the fiscal year.

Eight cases were closed by court action during the fiscal year, and costs paid amounted to \$120,576.

On June 30, 1958, of the 10 cases on the docket, 2 cases were under investigation by the Attorney General, 2 cases were pending disposition by the United States attorneys, 2 were under review by the Auditor's office, and 4 were under investigation by the Board.

PUBLICATIONS

The primary purpose of the Geological Survey is to provide for the people and the agencies of Government, information on the physical features of the country and facts necessary for the exploration, development, and conservation of our mineral and water resources. As this information becomes available through investigations, surveys and research, fulfillment of this purpose is served by publication in a variety of reports, maps, and charts. The information is published in part by the Survey, in part by cooperating States, and in part by many scientific journals. These publications include maps of the topographic and geologic features of the Nation, studies of mining districts and mineral deposits, of the composition and structure of rocks and minerals, of fossils and the rocks in which they are found, of geophysics and geochemistry, and studies of streamflow, ground waters, and their chemical quality.

During fiscal 1958, 917 reports including geologic and hydrologic data were submitted for publication. Of these 309 were for publication by the Geological Survey, 27 as professional papers, 59 as bulletins, 63 as water-supply papers, 11 as circulars, and 149 in the various map series, and the remainder for publication by cooperating agencies or scientific journals.

Preparation

In this period, 161 new manuscripts were sent to the printer and 167 were published. Work on new manuscripts prepared in the year 1958 included the editing of 26,384 pages; checking of galley proofs and 10,849 page proofs. Printed reports delivered included 39 professional papers, 52 bulletins, 56 water-supply papers, 7 circulars, and 13 miscellaneous.

Effective April 1, 1958, the Branch of Technical Illustration was established in the Office of Publications to improve the coordination of the illustrating services formerly provided by the Office of Illustrations and the Section of Geologic Cartography of the Office of Geologic Reports.

By the close of fiscal year 1958, the branch had completely transmitted to the printer illustrations for 273 new reports, an increase of 41½ percent compared with 1957. The classes of reports transmitted are as follows: Bulletins, 69; Professional papers, 27; Water-supply papers, 31; Hydrologic Atlas, 1; Circulars, 3; Geologic map series, 142; Geologic map series (Revision), 3.

The reports transmitted contained approximately 2,600 drawings and photographs. In this total are included 340 large black and white, and multicolor maps, and diagrams. An additional 486 miscellaneous illustrations were prepared for various administrative reports, open file reports, and outside publications.

Map Reproduction

The following is a summary of map reproduction work completed during the year:

| | New | Revised |
|--|--------------------|---------|
| Topographic Division maps: | | |
| Standard topographic..... | ¹ 1,498 | |
| Standard topographic (engraved)..... | 7 | |
| Standard topographic (revisions)..... | ² 214 | |
| 1:250,000 scale..... | ³ 115 | |
| Scale conversions..... | | |
| Planimetric..... | 4 | |
| State base..... | 13 | |
| State topographic indexes..... | | |
| Miscellaneous..... | | |
| Geologic Division maps: | | |
| Geologic quadrangles..... | 9 | |
| Mineral investigations..... | 45 | |
| Geologic indexes..... | 1 | |
| Coal..... | 5 | |
| Oil and gas maps..... | 12 | |
| Oil and gas charts..... | 2 | |
| State geologic..... | 1 | |
| Geophysical investigations..... | 37 | |
| Geologic status..... | 4 | |
| Miscellaneous investigations..... | 30 | |
| Conservation Division: River survey..... | 27 | |
| Water Resources Division: Miscellaneous..... | 2 | |
| Total..... | 2,026 | |

¹ Includes 7 printed by other Government agencies.

² Includes 10 printed by other Government agencies.

³ Includes 41 printed by other Government agencies.

⁴ Includes 52 printed by other Government agencies.

These 3,252 new and reprinted map editions comprise 8,185,165 copies of which 7,948,165 copies were printed in the Survey's plant. These maps range in size from 18 by 22 inches to 50 by 72 inches.

In addition to the foregoing production, 13,093 jobs comprising miscellaneous maps and other preliminary map services were completed. Printing includes 273 maps amounting to 791,091 copies of which 791,091 were illustrations comprising 468,143 copies for the Government Printing Office. The rest of the miscellaneous printing and service was done for other units of the Government, including branches of the Geological Survey. Also, 2,541 type jobs (impressions on cellophane for preparation) were delivered, and 1,238 maps were mounted on cloth.

The total cost of all production was \$1,760,011.16. Of this amount \$1,526,239.32 was received from other agencies and miscellaneous organizations as reimbursements for material, maps, printing, or service. The remainder of the cost, \$1,698,771.84 was charged to Survey funds.

The summary of the work performed in the Survey's plant includes: Reproduction and delivery of 8,739,256 map copies (46,908,403 impressions); preparation of 15,974 photolithographic printing plates, ranging in size from 22 by 34 inches to 50 by 72 inches; 37,919 photolithographic negatives; 6,057 photographic negatives and positives ranging from 2 by 2½ inches to 36 by 48 inches; 12,829 prints ranging from 11½ by 2 inches to 40 by 72 inches; developed and exposed 67 rolls of film; processed 20,887 sheets of strip film; and prepared 527 lantern slides.

During the past fiscal year, the flow of raw material and the flow of finished work has been streamlined and implemented by installation of new, larger, and higher-speed equipment.

The reprint program during the past year has approximately equaled, that of the preceding fiscal year. This program will, no doubt, continue.

During the year the printing of civil editions of the 1:250,000 scale maps was moved from the Army Map Service to the Geological Survey.

Distribution

The Geological Survey warehouses its maps and book reports at installations in Silver Spring, Md., Denver, Colo., and Fairbanks, Alaska. Distribution of the publications is carried on from these points and was aided during fiscal year 1958 by one other office in Washington and 11 other Survey offices in the field. Further distribution of maps is carried out by 470 commercial agents who purchase in resale to the public.

In addition to more than 35 million items on hand at the beginning of the year, 218,550 copies of 227 separate reports in book and pamphlet form, which were printed by the Government Printing Office and the Interior Duplicating Section, were received. Also received were 8,185,150 copies of 3,252 new and-reprinted maps.

The distribution of approximately 3,769,400 maps and map indexes and 292,650 book reports and pamphlets during fiscal year 1958 represented an increase of 10,000 copies over fiscal year 1957. In addition, approximately 115,000 copies of the Survey's monthly announcements and new publications were distributed through the Superintendent of Documents. This total distribution was accomplished as a result of some 203,000 individual requests and brought in \$491,395.29 from the sale of maps to the public, which amount was deposited as miscellaneous receipts in the United States Treasury. Receipts from other Federal agencies were \$36,735.44. Free distribution of maps for official, educational, and Congressional use was approximately 10 percent of all maps distributed.

The total number of copies distributed by the Geological Survey offices during this year as compared with fiscal year 1957 is shown in the following table:

| | Fiscal year 1957 maps, indexes and reports | Fiscal year 1958 maps, indexes and reports | Per- cent increased or decreased |
|--------------------------|---|---|---|
| Washington..... | 2,565,500 | 2,519,350 | |
| Denver..... | 1,191,300 | 1,240,950 | |
| Fairbanks..... | 36,000 | 31,000 | |
| Other field offices..... | 257,950 | 270,750 | |
| Total..... | 4,051,650 | 4,062,050 | |

PUBLIC INQUIRIES OFFICES

Public Inquiries Offices have been established in the following cities: Dallas, Tex.; Denver, Colo.; Salt Lake City, Utah; San Francisco and Los Angeles, Calif.; and Anchorage, Alaska. These offices carry stocks of Survey maps and reports concerning their respective areas, answer all types of inquiries, and direct specific questions on technical matters to appropriate Division technical officers. Maps and reports are sold "over-the-counter," but the offices are also equipped to handle mail orders. Operation of these offices facilitates distribution of the results of Survey investigations to the public.

FUNDS

During the fiscal year 1958, obligations were incurred under the direction of the Geological Survey totaling \$59,496,219. Of this

amount 63 percent was appropriated directly to the Geological Survey. 23 percent was made available by other Federal agencies, and 14 percent by States or their political subdivisions, and miscellaneous Federal entities.

Source and use of funds in fiscal year 1958

| | |
|---|---|
| Topographic surveys and mapping: | |
| Appropriation----- | \$14, 242, 406 |
| Reimbursements from non-Federal sources: | |
| States, counties, and municipalities----- | \$1, 755, 000 |
| Sales to the public of aerial photographs and copies of records----- | 174, 213 |
| Miscellaneous----- | 30, 078 |
| | <hr/> 1, 959, 291 |
| Reimbursements from other Federal agencies: | |
| Bureau of Reclamation----- | 1, 169, 245 |
| Department of the Air Force----- | 491, 736 |
| Department of the Army----- | 307, 155 |
| Miscellaneous----- | 138, 885 |
| | <hr/> 2, 106, 021 |
| Total appropriation and reimbursements----- | 18, 307, 718 |
| Direct State payments----- | 10, 139 |
| | <hr/> Total, topographic surveys and mapping----- <hr/> 18, 317, 857 |
| Geologic and mineral resource surveys and mapping: | |
| Appropriation----- | 8, 012, 931 |
| Reimbursements from non-Federal sources: | |
| States, counties, and municipalities----- | \$302, 059 |
| Miscellaneous----- | 4, 098 |
| | <hr/> 306, 157 |
| Reimbursements from other Federal agencies: | |
| Defense Minerals Exploration Administration----- | 504, 364 |
| Department of the Air Force----- | 138, 609 |
| Department of the Army----- | 1, 223, 778 |
| Atomic Energy Commission----- | 3, 972, 076 |
| International Cooperation Administration----- | 866, 670 |
| Government Printing Office—map reproduction----- | 115, 441 |
| Miscellaneous----- | 255, 995 |
| | <hr/> 7, 076, 933 |
| Total, geologic and mineral resource surveys and mapping----- | 15, 396, 021 |
| | <hr/> |
| For resources investigations: | |
| Appropriation----- | 10, 516, 049 |
| Reimbursements from non-Federal sources: | |
| States, counties, and municipalities----- | \$4, 882, 616 |
| Permittees and licensees of the Federal Power Commission----- | 223, 648 |
| Miscellaneous----- | 42, 874 |
| | <hr/> 5, 149, 138 |

Water resources investigations—Continued

Reimbursements from other Federal agencies:

| | |
|--|---------------|
| Bureau of Reclamation | \$1, 104, 754 |
| Department of the Army | 1, 527, 754 |
| Department of Agriculture | 362, 156 |
| Atomic Energy Commission | 339, 901 |
| International Cooperation Administration | 376, 824 |
| Department of State | 141, 860 |
| Tennessee Valley Authority | 97, 210 |
| Miscellaneous | 339, 138 |

\$4, 280, 990

Total appropriation and reimbursements

19, 951, 488

Direct State payments

947, 000

Total, water resources investigations

20, 900, 488

Soil and moisture conservation: Appropriation

16, 500, 000

Conservation of lands and minerals:

Appropriation

2, 225, 000

Reimbursements from non-Federal sources: Miscellaneous

2, 000, 000

Reimbursements from other Federal agencies: Miscellaneous

15, 000, 000

Total, conservation of lands and minerals

2, 360, 000

General administration: Appropriation

1, 200, 000

Special-purpose buildings: Appropriation for Pacific Coast Center

1, 150, 000

Summary:

Appropriation

37, 510, 000

Reimbursements from non-Federal sources:

States, counties and municipalities \$6, 939, 675

Miscellaneous 447, 219

7, 410, 000

Reimbursements from other Federal agencies

13, 610, 000

Total appropriation and reimbursements

58, 530, 000

Direct State payments

950, 000

Grand total

59, 480, 000

¹Excludes \$529,417 reimbursements from other agencies which are included under the substantive activities.

BUREAU OF MINES

Marling J. Ankeny, *Director*



The BUREAU OF MINES in fiscal 1958 carried on its mission of promoting efficiency, economy, and safety in the mineral industries serving as the focal point in the Federal Government for interpreting mineral statistics, both domestic and foreign.

In concert with the International Cooperation Administration, the Bureau sent engineers and metallurgists abroad to help friendly countries solve certain mineral problems and trained foreign technologists at its research stations throughout the United States. At the same time in the face of rising foreign mineral production and increased demand in strategic minerals by Soviet Bloc countries, the Bureau's fact-finding in regard to foreign mineral resources, production, consumption, and international trade was intensified.

Bureau staff members represented the United States at the Calcutta meeting of the Subcommittee on Minerals Resources of the Economic Commission for Asia and the Far East. Bureau representatives also presented papers at technical meetings in Germany and Sweden. At the same time they gave lectures before State Department foreign-service officers on the type of mineral information required from abroad and led brief trade missions at the Department of Commerce.

Typical of projects in which Bureau engineers assisted were construction of a chemical fertilizer plant in Pakistan, using locally mined phosphate and gypsum, and a pilot plant at Neyveli, India, using Indian lignite.

Another typical project of the year was arrangement for a Spanish-language edition of the Bureau's First-Aid Manual, following highly successful training classes in first aid and accident prevention in Mexican mining areas.

Foreign technologists who received training at Bureau laboratories in fiscal 1958 came from Afghanistan, Bolivia, Cuba, Formosa, India, Indonesia, Iran, Israel, Korea, Peru, Southern Rhodesia, and Thailand.

Subjects studied were mining, metallurgy, mineral dressing, use and preparation of fuels, mineral analysis, and health and safety.

Despite their importance, foreign programs constituted only a fraction of the Bureau's farflung activities. These activities include research and investigation of domestic mineral reserves, including appraisal, in cooperation with the Federal Geological Survey, of beryl occurrences in Hawaii; progress in inventorying possible sources of byproduct sulfur; and the initial step in a long-range program of cataloging, classifying, and evaluating beryl deposits in Northeastern, Southeastern, and Western States.

Still other Bureau research was directed toward developing more economical methods of mining and treating metallic- and nonmetallic-mineral ores; creating high-temperature alloys, cermets, and refractories; and producing pure metals. An outstanding metallurgical achievement was determination, for the first time in ironmaking history, of the composition of a blast-furnace charge. This was not possible when the Bureau's experimental blast furnace was quenched with nitrogen during normal operation.

A typical Bureau long-range research program, dealing with phase relationships of gas-condensate fluids (often called "waxy white oils") was completed during the year, and the first volume of a comprehensive report on the facts found and the techniques developed was published in cooperation with the American Gas Association. The report already has been recognized as one of the most significant contributions yet offered in conserving petroleum and natural gas.

In the field of safety, always of fundamental concern, the Bureau in fiscal 1958 began a pioneering research program necessitated by changing coal-mining techniques, particularly the growth of continuous mining. The rapid advance of continuous mining machines in a coal bed increases the volume of methane (an explosive gas), which must be diluted and removed by ventilating currents. At the same time, the great bulk of the machines makes difficult the circulation of enough air at the face to prevent dangerous accumulation of gas.

To meet this new hazard, the Bureau began experiments to find a device that will continuously monitor mine air, giving warning when the content of explosive gas reaches a certain level and shutting off all electrical power in any area where the gas content of the mine air nears the danger point. All industry and labor groups concerned with coal mining have joined the Bureau in its quest for a satisfactory measuring and warning device.

During the year there was an encouraging reduction in the proportion of coal-mine deaths caused by falls of roof and coal, and the Bureau took several steps to increase the effectiveness of its research and educational work in preventing such mishaps, still the leading cause of coal-mine fatalities. All laboratory and field studies in roof



Powerful electron microscope at the Bureau of Mines Central Experiment Station, Pittsburgh, Pa., is used to study pulverized coal and other materials.

trol were consolidated into a single group. Meanwhile, the Bureau continued its participation in a nationwide safety campaign aimed at curbing roof-fall accidents.

Gains were made in the control of coal-mine fires, and the total solid-fuel reserves thus protected by such efforts reached 288 million tons.

Throughout the year additional helium-recovery equipment was in operation at Exell, Tex., and a record output of 340 million cubic feet of this important element was achieved from all helium installations.

Near year's end, the Bureau called for bids for constructing 10 research structures at Fort Snelling, Minn., adjacent to Minneapolis and St. Paul. These will be dedicated to developing improved processes for utilizing mineral resources of the North Central States.

Two new radioisotope "tracer" laboratories were opened during the year to aid in minerals studies. Meanwhile, Bureau metallurgists succeeded in producing metals in purer form. One such metal, cerium—was coming from a Bureau laboratory in pound-a-day quantities, enough to encourage research on its possible uses for special alloys in rocket and missile development. One of the most promising immediate uses of cerium is as a "getter" of impurities from other metals, thus making possible their production in purer form.

In another field of research the Bureau likewise made progress. Seeking better ways for recovering minerals from the ground, engineers began experimenting with an improved type of phosphate-planer in a western mine. In the Pennsylvania anthracite region other engineers were planning tests with a new type of continuous mining machine, which has been used successfully in Europe in mining semihard coal.

The Bureau's coal research in fiscal 1958 was highlighted by a comparative study indicating that roof-bolting is more economical than conventional timbering in bituminous-coal mines. The program looking toward use of nuclear heat to gasify coal also advanced. A loop of the electrically heated, simulated nuclear reactor boiler was redesigned for operation at high pressures.

To improve the economic and statistical information provided the Government, industry, and the public, the Bureau began a program of collecting and interpreting facts on the detailed distribution of bituminous coal such as had not been available for many years.

As part of its continuing efforts to improve the health as well as the safety record of the mineral industries, the Bureau in 1958 began a study of the extent to which metal miners are exposed to harmful airborne dusts, and the nature of those dusts. This undertaking was begun, with the cooperation of mine operators, in the Western States.



Scientist from Thailand learns coal-analysis techniques under a training program for scientists of friendly foreign nations.

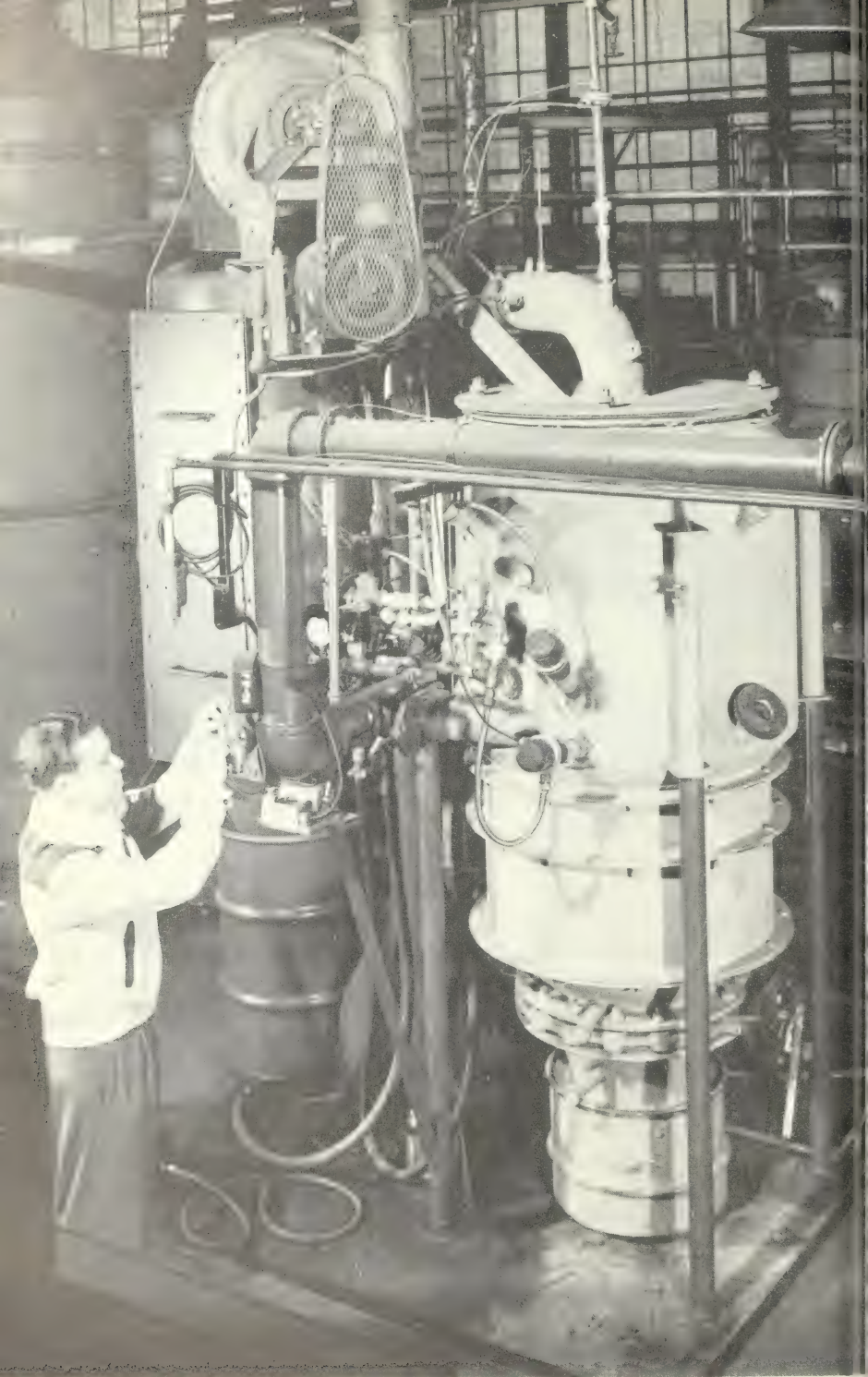
For the sixth full year, coal-mine inspection was carried on under the Federal Coal Mine Safety Act.

Bureau studies in all its many fields of endeavor were reported as fully as possible to the taxpaying public. An unprecedented number of publications emerged from the many studies and investigations and were made available to other Federal agencies, to the general public, to industry, and to technical groups and libraries.

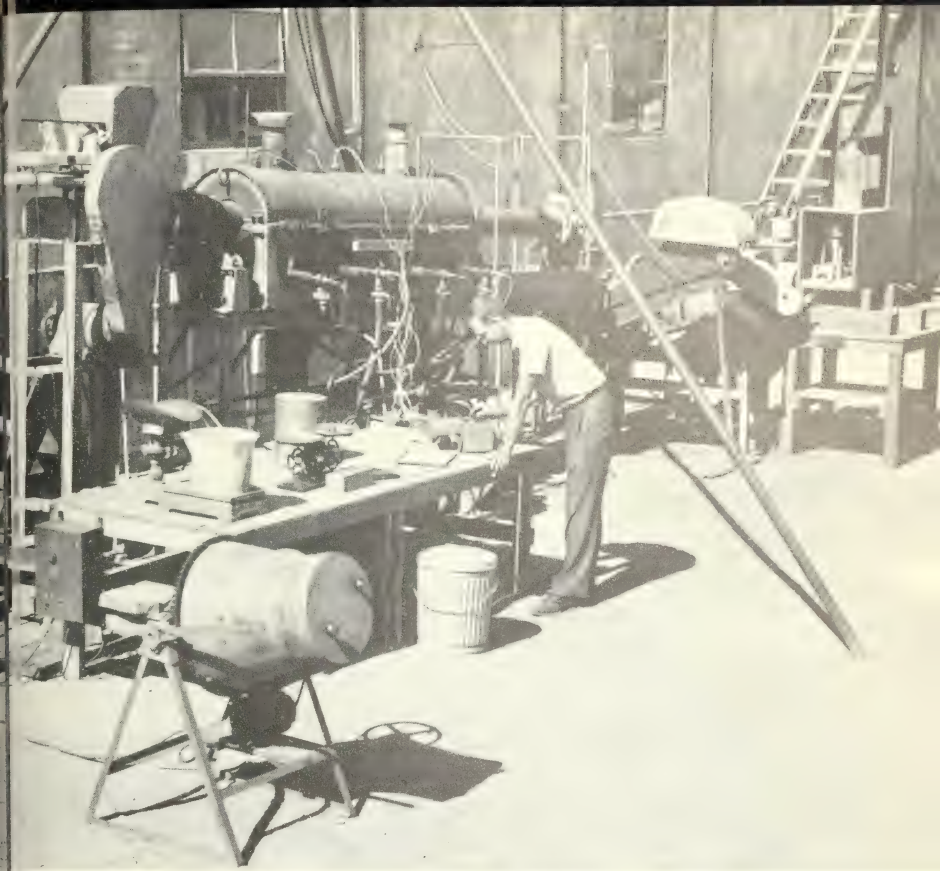
These and the many other attainments of the Bureau are described further in the pages that follow.

MINERALS DEVELOPMENT

Worldwide developments in 1958 emphasized the need for more information on mineral resources and industries and for intensified search to assure an adequate supply of minerals. The development of faster, long-range airplanes and missiles and the first manmade satellites were spectacular illustrations of the growing need for new and superior materials to enable man to take advantage of new scientific knowledge. Declines in prices of many minerals increased



At the request of the Atomic Energy Commission, scientists at the Bureau of Mines Central Experiment Station are developing this incinerator for the safe disposal of radioactive wastes.



ous reduction furnace at the Bureau of Mines Southwest Experiment Station, Tucson, Ariz., for treating certain copper ores that do not respond to conventional extraction processes.

pressure on technology to reduce costs of exploiting lower grade domestic resources. Continued international unrest gave high priority to the Bureau's defense activities.

The Bureau of Mines continued to provide the Office of Minerals Mobilization with commodity information and other services. Seven mobilization-planning reports were completed for which the Bureau had prime responsibility, and the Bureau contributed to six reports of the Department's Geological Survey. The Bureau also assisted the Office of Minerals Mobilization in developing data for the Special Exploitation Advisory (Pettibone) Committee report, Stockpiling for Defense in the Nuclear Age.

Members of the Bureau staff also were technical consultants to the Federal Services Administration. The Bureau and the Geological Survey participated in the Defense Minerals Exploration Administration program to discover strategic minerals.

A speedup project designed to bring about earlier publication of the Bureau's Minerals Yearbook progressed satisfactorily, and the backlog of work on volumes dated before 1957 was overcome.

Bureau scientists served on many committees and boards, including those of the American Society for Testing Materials; the American Institute of Mining, Metallurgical, and Petroleum Engineers; the National Academy of Sciences; the American Chemical Society; and the American Standards Association.

A continuing important function of the Bureau in fiscal 1958 was the revision and updating of commodity programs designed to guide scientific, technical, and economic research into appropriate and worthwhile avenues.

Base Metals

The Bureau completed a special study of domestic reserves of copper, lead, and zinc ore. This study provided important information for long-range and defense planning and revealed that in the 7-year period ended December 31, 1956, the measured and indicated reserves of zinc and copper increased substantially and the reserve of lead was maintained.

Collection of information on ore reserves at significant mercury deposits in the United States neared completion. Field examination and evaluation of copper deposits in Alaska and Washington and of antimony, mercury, and tin occurrences in Alaska continued.

Facts were compiled on mining methods and costs at open-pit and underground copper mines in Arizona, Montana, Nevada, and Washington. Applied physics research at three large underground copper mines in Michigan, Arizona, and Nevada and at open-pit copper mines in Nevada was expected to contribute greatly to higher extraction of ore, increased operating efficiency, and improved safety for employees.

Progress was favorable in the basic research on copper reverberatory-furnace slags to determine the effects of chemical composition on the viscosity and copper content of the slags. Metallurgical studies also continued on the flotation of copper, lead, and zinc ores; the treatment of complex copper oxide ores by continuous segregation; and beneficiation, leaching, and FluoSolids roasting of mercury ores and concentrates.

New studies were begun on high-purity, base-metal, mineral-metal combinations to develop more efficient methods of converting light (and heat) to electrical energy; on use of techniques employing radioactive materials to treat base-metal ores; on removal of oxygen from blister copper by using reducing gases; on electrolysis of galena concentrate to produce lead and sulfur; and on the chloridizing of base metal sulfides.

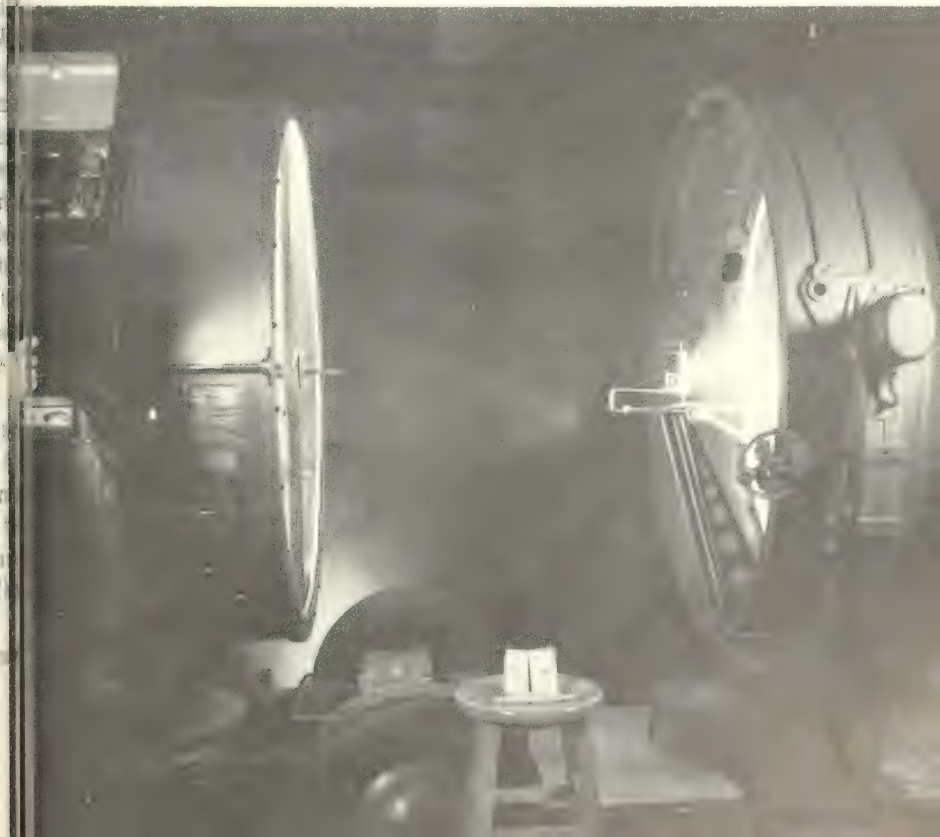
Investigations of methods of extracting base metals from secondary materials and plant residues progressed satisfactorily.

Ceramic and Fertilizer Materials

Research was intensified on new refractory materials for ultra-high-temperature uses, such as guided missiles, atomic reactors, and jet engines. The reactions of alumina, zirconia, and zircon in contact with selected rare-earth oxides were studied, and the sintering and ceramic properties of the same rare-earth oxides were measured. A furnace capable of reaching a temperature of 6,000° F. by using the reflected image of a luminous carbon arc was built to aid in evaluating the performance of these materials.

After underground tests with the Bureau's new phosphate-rock burner, minor changes were made preparatory to further tests under different conditions. The feasibility of planer mining had been studied, and mining techniques were being developed for using a modified longwall method in the inclined phosphate-rock beds in the western field. Beneficiation research was continued to develop processes to utilize grades of phosphate rock now wasted in Florida, Tennessee, and the Western States.

This flaming-arc-image furnace is used by researchers at the Bureau of Mines Eastern Experiment Station, College Park, Md., to evaluate refractories with melting points up to 6,000° F. The furnace was developed from war-surplus searchlights.



Research on synthetic mica emphasized a quest for substitutes for strategic natural sheet mica and investigations of new compositions in the large family of synthetic fluormicas. Synthetic minerals with water-swelling properties were produced. Under a cooperative agreement with General Services Administration, pure single crystals of synthetic fluorophlogopite mica were prepared and distributed as reference standards; samples of flake synthetic mica were furnished to industry; micas of various compositions were synthesized by melting and physical and chemical data were collected for several of the micas.

The Bureau continued studies aimed at developing abrasive and hard materials for use as cutting tools in rock-drilling or metal-working machinery and as high-temperature refractories. Enough high-purity borides of tungsten, columbium, titanium, tantalum, and zirconium were prepared to fabricate into rods, tubes, and crucibles.

Other research on ceramic materials included tests of clay and shale for lightweight aggregate and studies of clay and feldspar resources in the Western States, kaolin in the Southeast, and andalusite in Nevada.

Studies on the beneficiation of Missouri flint, burley, and plastic fire clay emphasized the removal of impurities by screening, tabling, concentration, cone classification, leaching, and ion exchange.

Construction and Chemical Materials

Bureau research on fluorspar was directed toward better use of the Nation's low-grade and complex fluorspar ores. Fluorspar deposits in several areas were examined and sampled. Barite-fluorspar flotation tests were made. Research advanced on the recovery of cryolite and aluminum fluoride from siliceous fluorspar ores.

Drilling of asbestos deposits in California was begun by the Bureau in the search of supplies for growing markets in the West. Research also was done on asbestos properties and on synthesizing asbestiform fibers. Emphasis was laid on developing various methods of analyzing and evaluating asbestos fibers, including use of the electron microscope.

The Bureau gave particular attention to current and prospective byproduct sources of sulfur, such as sulfide ores and waste industrial gases. Recovery of sulfur by decomposition of pyrites and gypsum was studied to increase the usefulness of these sulfur-bearing minerals.

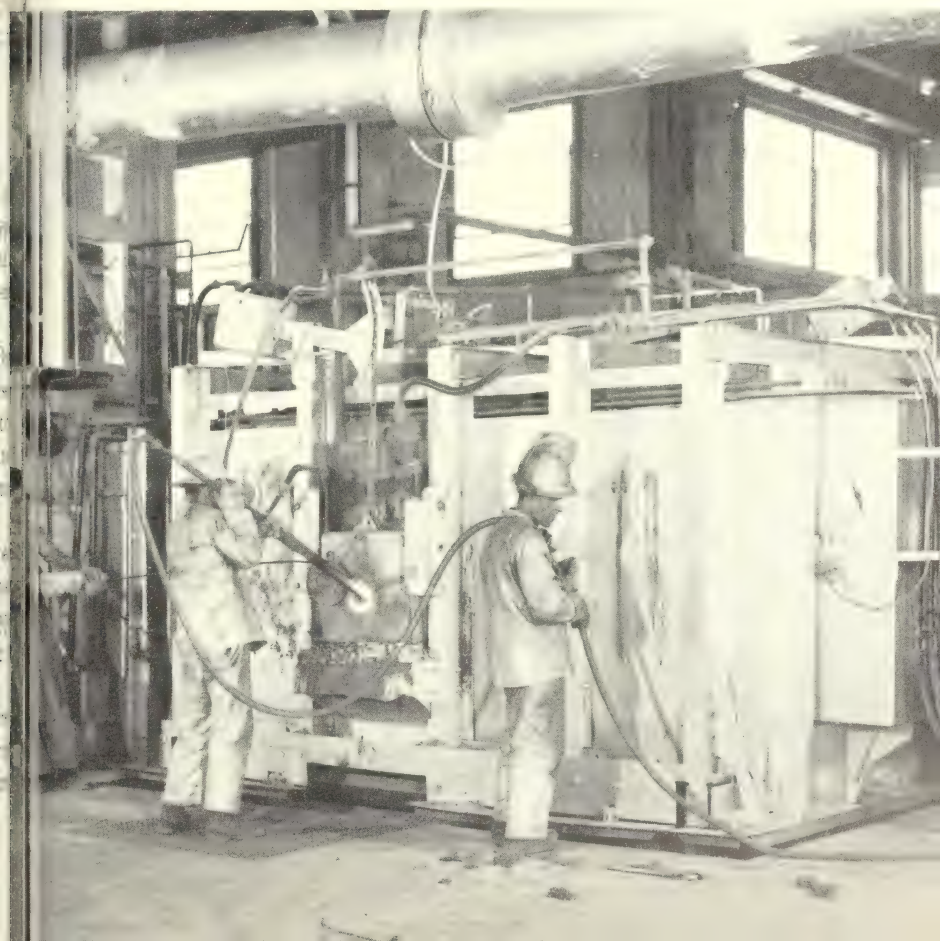
Methods of mining and processing mineral aggregates were surveyed in the Midwest and Southern States, and one descriptive manuscript was completed. Meanwhile, high-speed photomicro-

techniques were being used by Bureau physicists to study quarry-blasting methods, and preparations were being made for research on quarry-blasting vibrations to determine their effect on nearby properties and structures.

The Bureau made progress in developing and adapting special equipment for its methods of producing high-purity boron. Some boron was produced experimentally, and information was accumulated on its properties.

The water needs of the major mineral-processing plants in the Salt Lake drainage basin were surveyed, particularly as to quantity, quality, and costs. Information was collected on seasonal variations in water contamination at various points in the basin, and the influence of these contaminants of sulfide and nonsulfide flotation was investigated.

New steelmaking techniques and problems in ferrous metallurgy are investigated by the Bureau of Mines in this experimental open-hearth furnace. Here it is being used in recovering cobalt from nickel ore mined in Cuba.



A study was completed of the effects of soluble substances on hydration of gypsum plaster, and a manuscript was prepared on thermodynamic properties of this material.

Beneficiation processes were investigated to improve the recovery of spodumene from domestic lithium-bearing ores and to increase recovery of beryl, mica, feldspar, and other constituents of these ores.

A survey was made of industrial silica deposits in the Northwest to find new sources for alleviating a local shortage. Samples from many deposits were beneficiated and tested. Six deposits warranted further investigation.

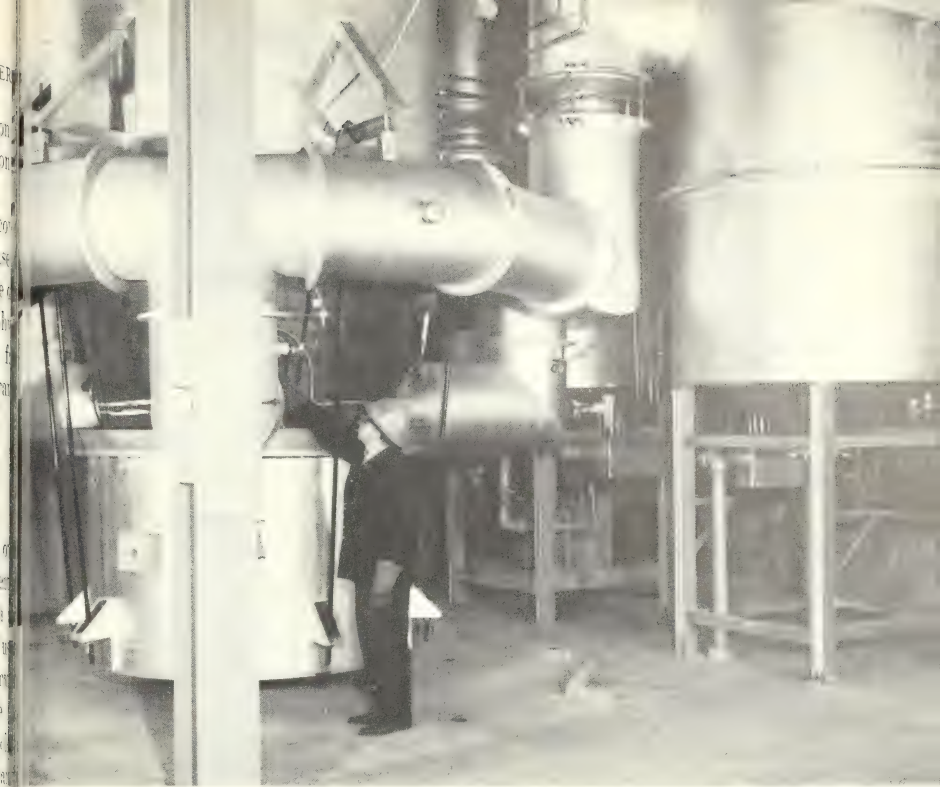
Ferrous Metals and Ferroalloys

Iron and titaniferous iron deposits in Montana, Colorado, and other Western States were studied to obtain information for direct metallurgical research by the Bureau. Simple concentration and smelting methods were developed for a Montana magnetite ore, using fuels and fluxes available in the Northwest. Tests on concentration of east Texas iron ores disclosed that partial reduction before concentration offers promise of significant results. Bureau research on southeastern iron ores developed data on concentration and partial reduction of the iron in the concentrate. Successful smelting of fired iron-ore-concentrate agglomerates in the Bureau experimental blast furnace at Pittsburgh, Pa., was a significant step toward commercial treatment of domestic low-grade iron ores. For the first time in the history of ironmaking, the composition of a blast-furnace charge column was determined by quenching the Bureau of Mines experimental blast furnace with nitrogen during normal operation.

A commercial grade of low-nickel, manganese stainless steel, a substitute for higher 8-percent-nickel grade, was successfully made by Bureau metallurgists from offgrade western ores. East Texas iron ore and pyrite cinder were smelted directly into commercial grade steel. Revised high-temperature physical constants improved understanding of high-temperature reactions. Studies were made to improve the quality of iron and steel scrap by removing residual elements. Equipment was installed for using radioactive isotopes to identify microconstituents of steel to determine their influence on physical properties of the steel.

Publications were issued on the use of statistical methods to compute ore reserves, on Oregon manganese deposits, and on chemical preparation of battery-grade manganese dioxide. Bacterial-leaching studies on manganiferous materials showed that manganese could be extracted under certain conditions.

A preliminary study was made of rhodonite deposits in Colorado. Magnetic concentration showed promise as a beneficiating method.



An experimental blast furnace, left, and the pebble stoves, right, are used by the Bureau of Mines in research to develop information to make possible greater efficiency and economy in ironmaking. Iron-bearing materials not now used in producing pig iron also are evaluated in this equipment.

Chromium research was aimed toward improving ore-treatment processes and developing ultrapure chromium metal and alloys. Substantial domestic concentrate was smelted to chromium alloys. Studies on low-grade chromite ores included research on flotation, roasting, leaching, and selective reduction smelting. High-purity ductile chromium was prepared and supplied to laboratories for special research, including the experimental treatment of cancer.

Research on nickel and cobalt resulted in improved roasting and leaching techniques for recovering additional nickel and cobalt in the feed at the United States Government plant, Nicaro, Cuba. A method was developed to reduce Nicaro nickel oxide powder to purification nickel.

In cooperation with industry, the Bureau continued to study the mechanics of mining by block caving. Research also progressed on the design of instruments for measuring rock stresses. Recovery of molybdenum from uranium-plant solutions was investigated, and separation of massive ductile molybdenum by bomb reduction of its oxides continued.

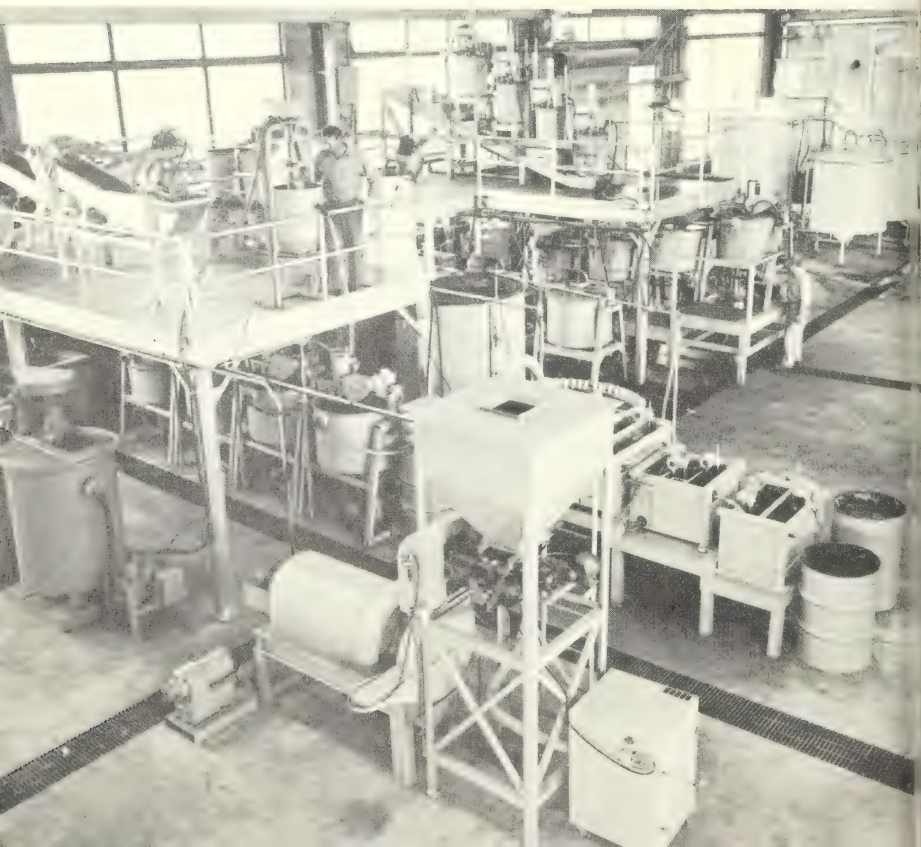
Bureau research on tungsten was influenced by the surplus supply and the increasing need for high-temperature alloys. Basic research on ultrapure tungsten was undertaken to provide facts needed in developing high-temperature alloys. Complementary to this effort was continuation of work on tungsten concentration and purification processes. Appraisal of western tungsten deposits also progressed, in recognition of the Nation's long-range needs.

Research advanced on extracting vanadium from leach solution, oxide purification, and metal and alloy production. Vanadium of unusually high ductility was prepared experimentally by fused-salt electrolysis.

Light Metals

A process, developed by the Bureau, was used for upgrading domestic bauxite at a new commercial alum plant. The process

The Salt Lake City, Utah, Station of the Bureau of Mines is the home of hydro-metallurgical continuous test units. At left, nearest camera, is a solvent extraction plant for uranium. In distance is an arrangement for processing nickel-cobalt and manganese ores.



es costs and substantially increases domestic reserves of chemical-grade bauxite.

The Bureau of Mines and Geological Survey jointly sampled low-grade deposits of Hawaiian bauxite.

A patent entitled, "Method of Extracting Aluminum from Aluminum-Silicon Alloys by Low Pressure," assigned to the Secretary of the Interior, was granted by the Patent Office. The patent resulted from Bureau research on preparing aluminum from aluminum-silicon alloys made from clays and similar low-grade domestic aluminous materials.

The Bureau's research aimed at developing improved magnesium alloys included evaluating the influence of composition, fabrication techniques, and thermal treatment on the vibration-damping capacity of the alloys. This study aided in determining the effectiveness of magnesium alloys under severe vibrational stress in aircraft and missiles.

The Bureau continued to investigate domestic titanium deposits. Two Bureau reports covering studies of deposits in Idaho were published, as well as a materials survey on titanium.

Laboratory studies continued on the Bureau's recently developed electrochemical method of producing high-purity titanium and included investigations aimed at developing a low-cost feed material for electrolytic refining. Under a cooperative agreement with the General Services Administration, the Bureau began work on a 10,000-ampere electrolytic cell to evaluate the commercial feasibility of a Bureau process for electrolytic refining titanium scrap and other titanium materials.

Titanium gate valves, cast experimentally at a Bureau laboratory, were tested in industrial plants and showed no corrosion or other failure after 6 months of operation in hot nitric acid, hypochlorite solution, and brackish river water.

Rare and Precious Metals

A rapid and reliable method was developed for analyzing minerals for individual rare-earth elements, using X-ray-emission, spectroscopic techniques. Whereas such analyses formerly required several days, the new technique cuts the time for preparing the sample and analyzing it for 7 rare-earth elements to only 35 minutes. Other work centered on separating, purifying, and preparing individual rare-earth elements. Electrolytically prepared cerium metal proved considerably purer than commercial metal and contained only spectroscopic traces of iron, carbon, and hydrogen. A production rate of 1 pound a day provided enough metal for research.

A Bureau of solvent-extraction process, already accepted by commercial producers for separating columbium and tantalum, improved by additional research. Arc-melting and electron-barcement methods for melting columbium and tantalum were to produce high-purity metals. The Bureau also succeeded in producing, for the first time, ductile columbium by Kroll-reduction methods followed by vacuum-distillation refining.

Meanwhile, other Bureau metallurgists sought improved methods for zirconium- and hafnium-sponge production, melting, and fabrication. Emphasis was on recovering scrap zirconium and niobium by fused-salt electrolysis and on preparing and studying niobium alloys.

A long-range program was begun to catalog, classify, and evaluate occurrences of beryl in Northeastern, Southeastern, and Western States. Analytical and test methods for identifying beryl were explored in search of a field method to aid in prospecting for beryl ores.

Bureau engineers, partly under a cooperative program with the Atomic Energy Commission, improved solvent-extraction and other processes for leaching and recovering uranium from its ores.

Studies of mining methods used in producing uranium ore reserves are in publication of three reports on specific uranium-mining operations.

FOREIGN ACTIVITIES

Although the Bureau's foreign activities in fiscal 1958 included technical assistance to underdeveloped countries and the training of their technologists in Bureau laboratories, its basic operations centered on factfinding related to foreign mineral resources, production, consumption and international mineral trade, and analytical reports dealing with the mineral economy of foreign areas.

With a depressed domestic mining industry facing increased foreign mineral production, lower metal prices, and greater Soviet activity in strategic mineral trade, the factfinding and analytical services of the Bureau were in great demand during fiscal 1958. Specialists were added to the staff to improve and increase coverage of the Soviet Bloc and Far East areas. Economic and technical information was obtained from industrial and private sources, foreign publications, 33,492 State Department foreign service dispatches, and 21,184 communications from the United Nations processed and distributed by the Bureau's liaison office.

Inquiries from Congress, other Government agencies, foreign governments, industry, prospective investors in foreign mineral resource development, importers, and exporters were answered through regular

Bureau publications, special purpose reports, 1,373 personal interviews, 2,009 letters, and 2,229 telephone calls.

In cooperation with the State Department, a lecture program for foreign service officers was established to explain the Bureau's work and emphasize the type of material required in foreign service reports. Area specialists also lectured on mineral resources for other Government agencies and assisted in briefing trade missions at the Department of Commerce. Staff members represented the United States at the Icutta meeting of the Subcommittee on Mineral Resources of the Economic Commission for Asia and the Far East, and spoke at technical meetings in Germany and Sweden.

Technical Assistance

Technical assistance to friendly nations throughout the world continued to be given by Bureau mining engineers, metallurgists, and chemical engineers under cooperative agreements with the International Cooperation Administration. Twenty-three engineers were assigned to 14 foreign posts during the year; 14 assignments were related to continuing projects, and 9 were for duty of less than 1 year. Afghanistan, Brazil, Ceylon, Cuba, Israel, Indonesia, Mexico, Nepal, Pakistan, Peru, Republic of the Philippines, and Tunisia received technical assistance from the Bureau in projects for exploring and exploiting their mineral resources.

A chemical fertilizer plant in Pakistan, using locally mined coal and gypsum as raw materials for manufacturing ammonium sulfate fertilizer, and a pilot plant erected at Neyveli, India, to investigate utilization of a large deposit of lignite were major projects in which Bureau engineers participated during the year. Both plants were in start-up phases of operation, and should contribute to the economic development of these countries.

Health and safety practices are emphasized in all foreign programs. In Mexico, the Bureau metallurgist arranged for a Spanish language edition of the Bureau's First-Aid Manual and pre-edition requests indicate that about 10,000 copies will be distributed in Latin-American countries.

Foreign Trainees

Foreign technologists were trained at various Bureau installations throughout fiscal 1958. During the year, 17 trainees completed assignments with the Bureau, and at year's end 12 trainees remained. They represented Afghanistan, Bolivia, Cuba, Formosa, India, Indonesia, Iran, Israel, Korea, Peru, Southern Rhodesia, and Thailand.

Training included specialization in the fields of mining, metallurgy, mineral dressing, utilization and preparation of fuels, mineral analysis, and health and safety practices.

PETROLEUM AND NATURAL-GAS RESEARCH

Production, Transportation, and Storage

An outstanding accomplishment of the year was completion of research and publication, in cooperation with the American Gas Association, of Bureau of Mines Monograph 10, vol. I, describing results, apparatus, and techniques used in a study of the phase relations of gas-condensate fluids or "water-white oils." The monograph originally was intended to help resolve problems relating to production of gas-condensate fluids. However, it also has become useful in most oil-recovery operations that require mixtures of natural gas and process gas with reservoir oil.

The correlations can be used for computing compressibility of gas at the pressure and temperature of the critical state, and dewpoints and liquid-gas ratios of phase diagrams. These properties are important in an operation that involves return of gas to a reservoir to obtain gaseous solutions or mobile liquids that will flow through the formation to producing wells.

Because gas-condensate fluids represent one-fourth or more of domestic gas reserves and nearly half the oil discovered each year is likely to be abandoned ultimately unless improved means are found to move it to producing wells, results of the research presented in the monograph are among the most significant technical contributions to conservation of petroleum and natural gas ever made. The completed work also is significant as a product of close cooperation among the Federal Government, State governments, and industry to promote conservation of mineral-fuel resources through technologic research.

When the work that resulted in Monograph 10 began in the early thirties, something was known of the physics and mathematics of the flow of fluids in natural underground reservoirs and in wells. However, little information about the properties of the lighter, gas-condensate fluids had been obtained by experimentation for use in quantitative engineering interpretation.

The cooperative research program of the Bureau with the American Gas Association on underground storage of natural gas continued throughout the year. Test procedures for giving the best deliverability date on underground storage wells were developed and a nongraphical method for estimating the potential producing capacity of gas wells was outlined. Also, theoretical treatments of gas flow



Engineers at the Bureau of Mines Petroleum Experiment Station, Bartlesville, Okla., use special equipment to trace water containing radioisotopes as it flows through underground oil sands.

igned to explain changes of well performance with time, were compared with results of actual tests on gas wells. A published report emphasizes the need for further theoretical studies.

A Bureau study of hydraulic fracturing in the north Texas area revealed that this method of well treatment substantially increased ultimate oil recovery. Within 2 years after fracture treatments, 182 commercial wells yielded 1,278,000 barrels of oil that otherwise would have been recovered by primary means. Seventy-five to eighty-percent of all treatments in this area have proved successful.

Preliminary work was begun in the Williston basin in Montana and North and South Dakota, an important potential oil-producing area. Several typical fields there will be selected for technical studies of the characteristics and behavior of oil accumulations and attendant oil-production problems in this growing new oil province.

Research in surface chemistry showed that propane-deasphalting treatment can minimize harmful effects of some complex metallic organic compounds in crude oils during processing and use. These complex compounds can be expected to influence the flow of fluids in reservoirs. Further research may yield valuable information on source beds and migration of petroleum.

Thirty-one reports on the many phases of current oil-production research were prepared for publication.

At the Bureau of Mines Appalachian Experiment Station, Morgantown, West Virginia, new types of electrical well-logging equipment are used in studying geological formations surrounding oil wells.



Chemistry, Thermodynamics, and Refining

Research on sulfur in petroleum included studies of fractions of Wasson, Tex., crude oil boiling to 250° C. Gas chromatography was used to identify 18 sulfur compounds in crude oils from Wasson, Tex., Wilmington, Calif., and Agha Jari, Iran. Chromatographic equipment was designed and built by the Bureau specifically for this work. Several organic sulfur compounds were purified as reference standards in a cooperative program with the American Petroleum Institute. In research on nitrogen in petroleum, a sample of Wilmington, Calif., crude oil was deasphalted with pentane, the separated into fractions by molecular distillation. At the year end narrow boiling-range cuts were being prepared from these deasphalted fractions, preparatory to concentration and isolation of nitrogen compounds by absorption techniques. One sample of a standard organic nitrogen compound was prepared by using zone melting techniques that the Bureau developed for the purpose.

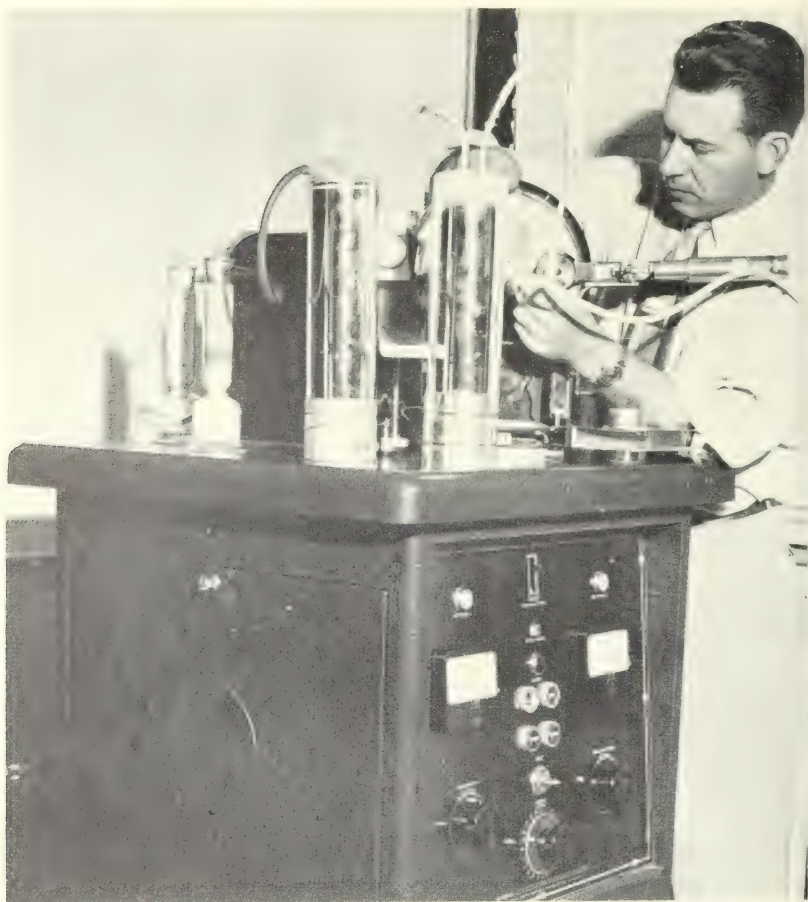
Facts on the properties of motor gasolines, aviation and diesel fuels, and burner fuel oils were published in a new series of periodical reports entitled "Petroleum Product Surveys."

Thermodynamic studies were made of 21 hydrocarbons and other organic compounds, including one of interest in connection with Ethyl Corporation's new gasoline additive that reportedly increases the effective power of aircraft and automotive engines using a given fuel. Improvements to equipment included design of a new gas-compressibility apparatus using gallium instead of mercury as a pressure-transmitting fluid. Being built as the year ended, this will permit more accurate determination of pressure-volume-temperature relationships.

The usual crude-oil-analysis program was supplemented by 30 relatively large-scale and specialized analyses from key fields in a program supported by the Air Materiel Command. This information, correlated with that obtained by routine analysis, is being used to inform the military on the availability of aviation fuels in current and potential use as affected by specified properties.

Research on the stability problems of fuels in storage was continued. For diesel-type fuels, emphasis was placed on the oxidation characteristics of the individual hydrocarbon components and the contribution of polar compounds to instability. Research on gasolines emphasized development of accelerated aging techniques and study of gums, particularly the role of sulfur and nitrogen compounds in gum formation. Preliminary plans were made to use radioactive labeling to follow the course of gum formation.

Studies on the composition of exhaust gases involved analysis of exhaust from a dynamometer-loaded automobile engine operated



This X-ray diffraction apparatus at the Laramie, Wyo., experiment station yields information on the constituents of oil shale and shale oil.

under closely controlled conditions on pure hydrocarbons and typical gasoline blending stocks. A three-stage gas chromatographic analyzer was developed, capable of resolving mixtures containing many as 60 hydrocarbon components. The method is being improved to permit analysis of oxygenated compounds.

Twenty-six reports giving results of Bureau research on petroleum thermodynamics, chemistry, and refining were prepared for publication. Twenty-two reports, including 10 of these, were presented orally at technical meetings.

Petroleum and Natural-Gas Economics

The oversupply of petroleum in the United States after the Suez Canal was reopened led to establishment of the Government's Vol-

ery Oil Import Program. The regular reports of the Bureau of Mines and special forecasts made for the Administrator of this program were used in formulating recommended levels of imports.

Work was begun on a long-range forecast of United States petroleum demand as a part of the petroleum study requested of the Department by the Office of Defense Mobilization.

Through its regional offices the Bureau of Mines began correlation of Bureau- and State-collected crude-oil-production statistics.

The scope of Bureau petroleum statistics was described before the Committee on Petroleum and Natural Gas of the Advisory Council on Federal Reports, which reviews all Government petroleum statistics and recommends needed changes.

OIL-SHALE RESEARCH

Laboratory research on the constitution of oil shale and the characterization of shale oil continued to yield results that would be useful to any agency considering commercial oil-shale development. Treatment with mineral acid of 10 oil-shale samples composited from the Mahogany-zone section and averaging 25 gallons per ton yielded organic concentrates, which were used to determine the elemental composition of organic material of the shale.

During the year more than 13,000 assays of Green River oil shale were made, increasing our knowledge of the extent and richness of this large potential oil reserve.

Progress was achieved in characterizing shale-oil components. A paper embodying the results of the Bureau's work on the nitrogen compounds of shale oil was presented to the American Chemical Society.

Two papers on spectroscopy, one of the main techniques for identifying types of organic compounds in shale oil, were presented before the American Society for Testing Materials.

Additional facts have been obtained on the pore-size distribution of inorganic constituents of Colorado oil shale. These may be important in any future underground treatment of shale.

Work on the decomposition of shale organic matter by microorganisms continued on a macro scale. This method promises to yield quantities of decomposition products large enough to be identified.

HEALTH AND SAFETY ACTIVITIES

Continued increase in mechanization of the mineral industries during fiscal 1958, especially the rapid spread of continuous mining, in-

tensified various older hazards or introduced new ones, and requiring modification and improvement of the Bureau's safety and health programs. As in the past, research and training formed the keystone of these activities.

Roof support and the effect of mining operations on the characteristics of overburden received special emphasis during the year.

To solve another problem of growing importance—assuring adequate face ventilation in gassy coal mines operated by continuous mining methods—the Bureau began a research program to develop a monitoring system to deenergize electric-powered face equipment automatically when concentration of methane (an explosive gas) reaches a predetermined level. A collateral study dealt with suppression of dust generated by mechanized mining.

Studies continued on developing safeguards against exposure to airborne dusts and preventing mine fires and explosions. Through coal-mine inspections and enforcement of the Federal Coal Mine Safety Act, the Bureau endeavored to improve the safety of the Nation's coal mines, but during the fiscal year 4 major disasters—2 explosions and 2 falls of roof—resulted in a total of 27 fatalities.

Work on Primary Hazards

Roof falls caused 53 percent of the underground coal-mine fatalities in 1957 compared with 63 percent in 1956. Another campaign was begun, in cooperation with other agencies, to reduce roof-fall accidents further.

The use of roof bolting in mining and tunneling continued to gain in popularity. Roof-bolted mines increased 14 percent and tonnage mined under roof-bolt support 15 percent in 1957. Of 213 roof-fall fatalities in bituminous-coal mines, during 1957, only 13 were attributed to failure of bolted roof.

During the year the Roof Control and Roof Control Research Sections were consolidated into a single Roof Control Research Group to coordinate laboratory and field work. Studies were conducted to improve bolting practices, develop warning devices, evolve an electronic device for exploring mine roof, determine the causes and control of coal outbursts, formulate methods of cementing mine roof, and devise portable, protective, roof shields for mechanical mining.

Of major importance was the study begun to develop a continuous methane monitoring system for each piece of electric-powered equipment operated in face areas of gassy coal mines. The goal is a practicable device that will give a signal or warning when 1 percent methane is encountered and automatically cut off power from the working section at 2 percent methane. The following steps were

on: A search of literature on methanometry, consultation with instrument manufacturers, field trips to mines and laboratory tests of components of such systems, and formulation and distribution to interested persons, agencies, and manufacturers of proposed specifications.

Testing Equipment

Increasing coal-mine mechanization was reflected in the mounting workload of Bureau engineers who test mining equipment for acceptability.

During the year 133 approvals and 150 extensions of approval were issued under 12 testing schedules. Approvals covered continuous and conventional mining machines, loading machines, conveyors, shuttle cars, a stratascope, a coal breaker, a cable-reel locomotive, compressors, roof drills, a hydraulic power unit, distribution boxes, an air blower, a wet rock-dust distributor, 2 mine-lighting systems, a post holder, a mechanical timberman, an electric shaft shovel, utility trucks, a roof-bolting machine, and 5 diesel units for noncoal mines, including a locomotive, 2 shuttle cars, a utility truck, and an ore carrier.

Sixty-seven compartments were inspected, and 75 explosion tested; 23 explosion tests were made in natural gas-air mixtures; 72 cables were flame tested and 23 were subjected to damage-resistant tests. Sixty conveyor belts were accepted as flame resistant; including 6 manufactured by companies not previously listed, 3 of which are in Belgium, Canada, and Germany respectively.

Five drill-dust collectors for coal mines were approved, and 12 extensions of approval were granted.

One hundred and nine extensions of approval were granted on conventional respiratory-protective equipment, including gas masks and supplied-air, dispersoid, and nonemergency gas respirators. Research and development were completed on equipment for testing respirators for use during spray painting and drafting performance requirements needed completion.

A small, portable, explosion-proof, photoflash unit was developed for use in gassy coal mines. It is lighter and more compact than a similar unit developed in fiscal 1957.

A schedule covering 10-shot short-delay blasting units was issued, and a revision of the mine-lighting schedule was prepared for publication.

A marked increase in polyvinylchloride, plastic-covered cables indicated possible replacement of neoprene as a jacket for trailing cables.

Special laboratory space and equipment were obtained to broaden the Bureau's approval system to include testing of respirators for effectiveness against radioactive aerosols. New techniques under development included a high-sensitivity test of peripheral face fit and an apparatus for simulating human respiration and measuring instantaneous respiration.

Health

The Bureau continued to promote healthful working conditions in the mineral industries through work on gases, dusts, respiratory protection, and mine ventilation.

During the year, 18,897 gas samples were analyzed, including 18,200 obtained during Federal coal-mine inspections. Others came from sealed fire areas in coal mines, metal and salt mines, tunnels under construction, tests of diesel-powered equipment used underground, tests of respiratory-protective equipment, and miscellaneous field and laboratory investigations. Infrared spectrometry was used to determine methane in particularly important samples of coal-mine atmospheres, and the significance of carbon monoxide in sealed fire areas in coal mines was scrutinized. Field studies of diesel equipment were made in mines and tunnels, and hazards from toxic gases were investigated in several industrial plants.

A survey of working environment in metal mines was begun in the Western States during the year. More than 600 samples of airborne dust were examined to determine concentration and particle size, and over 100 samples of dust and dust-source materials, collected in field studies, were analyzed by X-ray-diffraction, spectrographic, and chemical methods to determine harmful constituents. Dust conditions were surveyed in two coal mines.

Ventilation was studied by the absolute-pressure method in 4 coal mines; field studies were made and ventilation practices were evaluated for 2 coal mines and a vehicular tunnel under construction, and many observations were made of auxiliary face ventilation in coal mines where continuous mining machines are used. Research on face ventilation for continuous mining systems in gassy coal mines was conducted under controlled conditions in the Branch of Health Research Experimental Mine at Bruceton, Pa.

The electric analog, which was modified to increase its capacity, was used to solve many mine-ventilation problems. Discussions with representatives of the mining industry covered ventilation problems with continuous mining machines, possible hazards in the use of multiple main fans, application of principles of exhaust ventilation, and initial design of safe and efficient mine ventilation systems.

Safety Education

Because injury records have proved the value of accident-prevention training, production of the Bureau's mine-safety films used in this work was expanded. Bureau safety films were shown to 95,000 persons during the year.

Approximately 12,000 persons completed the Bureau's various accident-prevention courses, bringing those trained since 1931 to 225,000, of whom 210,000 took the coal-mine courses. Bureau records show the greatest improvement in safety at mines and plants where every official and workman has received training, so emphasis upon 100-percent participation was intensified.

At year's end 1,948,000 persons had completed the Bureau's first-aid course, and 116,000 had taken its mine rescue courses since 1910. The Bureau continued to encourage interest in first-aid and mine rescue training by sponsoring and furnishing judges and other officials for local, State, and national contests and by sponsoring the Holmes Safety Association, a national organization at whose council and local chapter meetings the causes of injuries and means of preventing recurrences are discussed.

Bureau representatives investigated dust explosions in industrial plants and served on national technical committees that prepare preventive codes and standards.

Accident Analysis

The Bureau's analysis and tabulation of injury and related employment records continued to provide guides for developing better accident-prevention programs for the mineral industries. Besides the regular annual and monthly reports, many special tabulations were made for Federal and State agencies, trade associations, labor unions, and others.

Industries canvassed for injury and employment information included coal mining, coke manufacturing, peat, quarrying, metal and nonmetallic-mineral mining, metallurgical operations, and petroleum and natural-gas production and refining. For the first time, the Bureau was able to publish severity as well as frequency rates for the metal- and nonmetallic-mining industries.

The 33d National Safety Competition and four other safety competitions were conducted by the Bureau; approximately 1,000 mines, quarries, and plants participated. About 2,000 Certificates of Accomplishment in Safety were presented to supervisors and workmen at winning plants.

Control of Fires In Inactive Coal Deposits

At year's end the Bureau had extinguished or controlled 61 of the 190 known fires in coal deposits not now being mined—35 on the public domain and 26 on private property. Coal reserves conserved under this program since fiscal 1949 were estimated at 288 millions of tons.

Six fire-control projects were completed in fiscal 1958, 3 on public lands and 3 on private property. Work was in progress or being scheduled on 10 others—5 on the public domain and 5 on private property.

Future plans call for maintenance work on completed fire projects and the start of new ones, in order of urgency, as appropriation permit. The Government pays the full cost of controlling fires if they are on Federal land but not more than half the cost if they are on private property.

Coal-Mine Inspection

For the sixth full year, coal-mine inspection was carried on under the Federal Coal Mine Safety Act. Besides Title I, authorizing the Bureau to enter and inspect coal mines, report on hazards, and recommend (but not require) their correction, the act, in Title II, includes specific enforcement provisions designed to prevent explosions, fires, inundations, and man-trip and man-hoist accidents in mines regularly employing 15 or more men underground.

The Nation had approximately 10,879 active coal mines in 1957 including 1,484 Title II mines, 7,659 small Title I underground mines, 150 auger mines, and 1,586 strip mines. At the end of fiscal 1957 the Bureau had 249 coal-mine inspectors, 22 engineers and 11 coal-mine inspectors (electrical) assigned to coal-mine inspection and related duties.

During the fiscal year, 3,251 routine inspections were made of coal mines subject to Title II, 33 jointly with State inspectors under State-Bureau cooperative agreements. In addition, 1,457 special inspections were made to determine whether violations of mandatory provisions had been abated.

Federal inspectors observed 7,741 violations of the mandatory safety provisions: many were corrected immediately and required no formal action. They issued 1,183 notices setting a reasonable time for abating dangers, 488 granting time extensions, and 1,227 certifying that dangers had been totally abated.

During the year 82 orders were issued, requiring withdrawal of men from all or parts of 57 mines. These included 48 orders at 33 mines because of imminent danger, and 34 orders at 19 mines because

failure to abate violations within a reasonable time. By comparison, 83 withdrawal orders had been issued at 57 mines during fiscal 1957.

Orders were issued classing as gassy seven mines formerly considered nongassy. The Federal Coal Mine Safety Board of Review, an independent agency, denied one appeal by an operator for annulment of a gassy-classification order. The United States Court of Appeals, ruling on an appeal by the mine operator, affirmed the Board's denial of an application for annulment of a gassy-classification order issued during fiscal 1957.

Federal inspectors and engineers also made 7,964 routine inspections of smaller mines (including 1,144 at strip mines and 104 at auger mines); 700 electrical, ventilation, dust, blasting, and related surveys; and 574 investigations of fatal and serious nonfatal accidents, mine fires, gas and dust ignitions, and miscellaneous conditions.

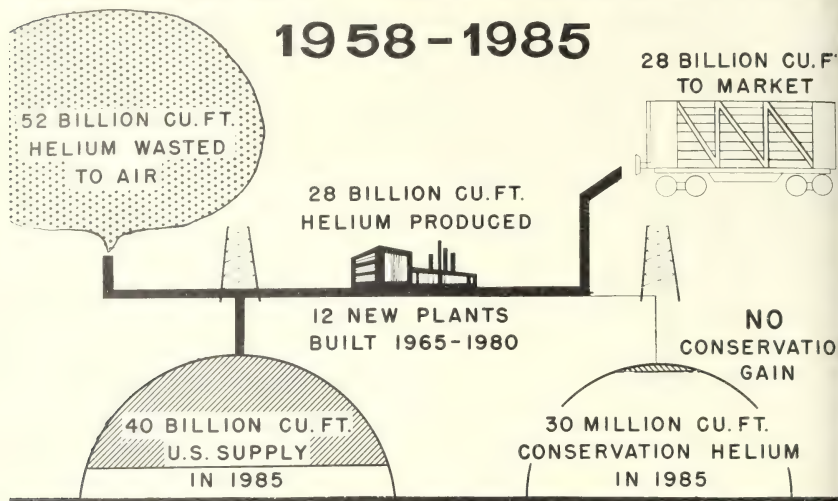
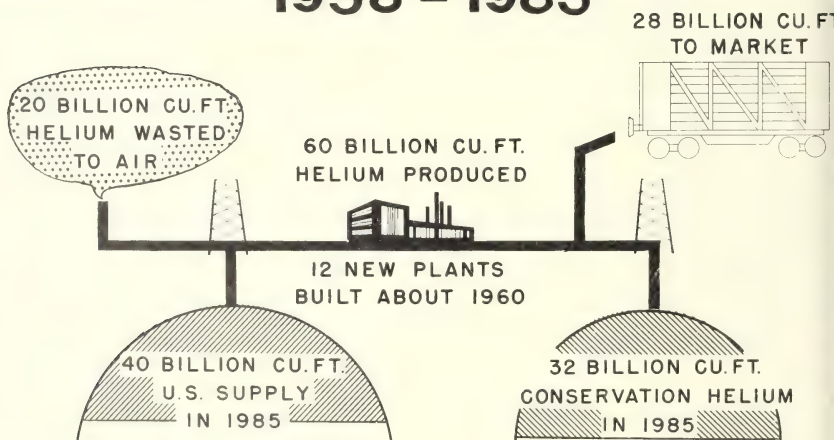
Four major disasters (single accidents causing 5 or more deaths) occurred during the fiscal year; 2 were caused by explosions and 2 by roof falls. Preliminary reports show 473 coal-mine fatalities in calendar 1957, compared with 445 in 1956. The fatality-frequency rate per million man-hours of exposure also increased from 1.10 in 1956 to 1.17 in 1957. The fatality-frequency rate for the first 5 months of 1958 was 0.98.

HELIUM

The Bureau of Mines helium program assumed new significance in 1958, when the Department of the Interior announced a new national helium-conservation policy designed to save, for the future, much of the helium now being wasted into the atmosphere without serving any useful purpose when untreated helium-bearing natural gas is burned. Putting the policy into effect would involve constructing as many as 12 new plants at an estimated cost of \$224 million. These plants would extract helium from natural gas en route to fuel markets, thus conserving about 32 billion cubic feet of helium, in addition to meeting anticipated current needs to 1985.

Adoption of the new conservation policy culminated several years of study by the Bureau and the Department, and reflects growing awareness of the importance of helium to the guided-missile and atomic energy programs as well as to other Government, industrial, medical, and research activities.

Helium production and shipments established new records in fiscal 1958. The four Bureau plants at Amarillo and Exell, Tex., Shiprock, N. Mex., and Otis, Kans., produced 340 million cubic feet of new helium. The Amarillo plant also withdrew 9 million cubic feet of

WITHOUT CONSERVATION**1958-1985****WITH CONSERVATION****1958-1985**

The Department's helium-conservation program would save an estimated 32 billion feet of this valuable lightweight gas that would otherwise be lost forever.

conservation helium from storage in the nearby Government-owned Cliffside gasfield. The year's shipments of helium totaled 331 million cubic feet.

These records were made possible by the expanded facilities at the Exell, Tex., plant, which were put into service in June 1957. This plant can produce 250 million cubic feet of helium annually.

an adequate supply of helium-bearing natural gas is available throughout the year. In 1958, however, variations in the gas supply and some other adverse factors limited its output to 200 million cubic feet.

Reductions in the volumes of available helium-bearing gas also limited the output of the Shiprock and Otis plants during the year. Efforts to revive the two Government wells in the Rattlesnake field failed, so both were plugged. One additional well (making a total of two) was drilled by the private operator in the Hogback field, but water encroachment and other difficulties caused an overall decline in the availability of gas from that source to the Shiprock plant. Consequently, the plant was operating at about 50 percent capacity at year's end. The longtime downward trend in the production of helium-bearing gas in the vicinity of the Otis plant continued.

Consequently, although new records were established over all, the year's output fell short of Bureau expectations and failed to pace continually increasing demands. It was necessary to resort again to an informal allocation system to assure distribution of the available helium in the best public interest. The supply at year's end was barely adequate to meet important defense, atomic energy, medical, and research needs. Virtually no helium was available for less essential civilian uses.

In anticipation of the need for an additional plant to meet current demands (separate from the conservation program), the Bureau of Mines entered into an agreement with the Colorado Interstate Gas Co., April 4, 1958, by which the Government obtained the right to extract helium from all the company's helium-bearing gas in the Hayes field of Cimarron County, Okla. This field contains 8 to 10 billion cubic feet of recoverable helium and would be an excellent source of supply for a new plant.

The distribution of helium consumption between Government and private users continued to be about 75 percent Government and 25 percent private. Most of the private consumption was for defense and atomic energy contracts; consequently, 90 percent or more of total consumption was related to important Government programs. Major uses continued to be missiles, blimps, welding, atomic energy, and aerology. Intensified scientific interest in cryogenic research at extremely low temperatures portends important new developments in this field. The low temperatures involved—within 2° of absolute zero (-459.6° F.)—can be achieved only through the use of liquid helium.

Thirty new railroad helium tank cars were received during the year, bringing the total in the Government pool operated by the Bureau of Mines to 137.



This pilot equipment, known as a fixed-bed pressure gasifier, was installed by the Bureau of Mines at its experiment station in Grand Forks, N. Dak., for tests of utilization of lignite.

The Bureau continued research on the properties and characteristics of helium-bearing natural gases and on problems regarding helium extraction from natural gas. No important new sources of helium-bearing gas were found in the continuous survey and the analyses of new natural-gas occurrences in the United States.

The Bureau continued to work with the Navy and the Bureau of Standards in evaluating and developing plans for producing and transporting liquid helium.

BITUMINOUS-COAL RESEARCH AND RELATED ACTIVITIES

Although the long-term outlook for bituminous coal continued promising, the ability of this fuel to meet the substantially increased energy requirements anticipated at home and abroad will depend to a large extent upon more research pertaining to coal production, distribution, and utilization.

Technologic Research

The Bureau's research programs on bituminous coal in fiscal 1958 covered a broad area, ranging from the mining of coal to its final utilization, and were concerned with improving present methods of obtaining, processing, and using coal and in developing new methods and markets.

One study provided a basis for comparing plans for mining and combinations of equipment that would be particularly suited to various geologic conditions. Another study, comparing conventional mining methods and roof bolting, indicated that ultimate costs were lower with roof bolting because labor was saved and productivity increased. A program for evaluating hydraulic-mining techniques was outlined, material requirements were determined, necessary equipment was purchased, and a plan to evaluate the use of this method under American conditions was drawn up.

In coal-preparation research the Bureau's studies on methods of cleaning fine sizes of coal, on the flotation mechanism and use of reagents, on liquid-solid separation methods to minimize stream pollution caused by the waste from preparation plants, and on the performance of new equipment developed both here and abroad were directed toward achieving the optimum utilization of mined coal.

Reports describing the preparation characteristics of coals in three counties in Virginia and Kentucky were published to give information on the possibilities of upgrading coal by preparation methods to meet requirements for metallurgical coke. Similar studies in other

counties continued. The Bureau's study of the carbonizing properties of American coals resulted in the publication of three reports on coals in Kentucky, Pennsylvania, and West Virginia during fiscal year.

In the study of the mechanism and kinetics of coal carbonization, the expanding properties of several coking coals, the effect of fluid on coking, and the thermal-decomposition characteristics of high molecular-weight materials were evaluated. Correlation of carbonization facts obtained with different types of experimental units used at Pittsburgh, Pa., Denver, Colo., and Tuscaloosa, Ala., was begun.

Since coal is still used primarily for generating heat, the Bureau continued to study combustion characteristics, the performance efficiency of furnaces used by electric utilities and other industries, the use of waste products (such as fly ash), and the prevention of air pollution.

Increasing population and per capita consumption of energy have raised energy requirements significantly during the past decade. Projected consumption is expected to rise steadily, indicating a need for alternative development of energy sources. The ability to effect economic conversion of coal to gas, liquid fuels, and chemicals appears essential in meeting future national requirements for these products. Direct hydrogenation of coal, and gasification of coal followed by catalytic conversion of the gas by the Fischer-Tropsch process, are two approaches to solving this problem that the Bureau has been investigating.

The feasibility of coal hydrogenation has been demonstrated. Bench-scale and pilot-plant hydrogenation investigations at low pressure and with new catalysts of high activity continued, however, an attempt to develop a practical and economic process.

Research on the Fischer-Tropsch process included the development and testing of catalysts, their preparation and characterization, sulfur prepoisoning, and the effect of sulfur on catalyst life and activity. The hot-gas recycle system is one of several processes under development for the Fischer-Tropsch synthesis or for production of high-B. t. u. gas. This system offers the advantage of operation at elevated temperatures, resulting in high yields of gasoline. Various catalysts were evaluated, and steel lathe turnings proved suitable.

Since the cost of synthesis gas produced from coal represents a large fraction of the total cost of synthetic liquid and gaseous fuels, attempts are being made to conceive and develop methods for reducing these costs. One proposed method involves application of nuclear heat. In cooperation with the Atomic Energy Commission, the Bureau began to develop and test construction materials, equipment, and process components for a nuclear-heated coal gasifier.

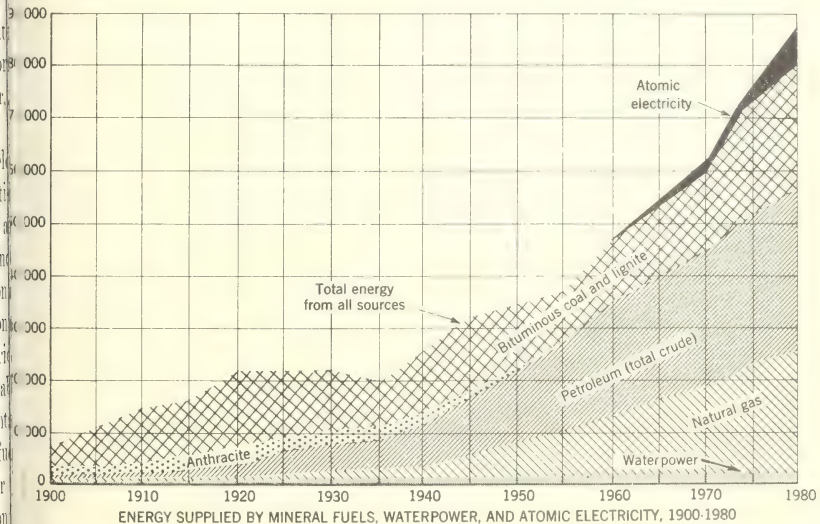
ulated nuclear reactor, heated electrically by induction, was designed and constructed for tests at atmospheric pressure. Since coal gasification is best conducted at high pressures, the loop was redesigned for operating at these pressures to give information for "in-pile" design and testing.

In underground gasification the Bureau's experiments on a 3-foot bituminous-coal bed have indicated that, at present, gasification of such a coal bed is not economic in this country; a new technology and process appears to be needed to make underground gas from such coal beds economically attractive.

The Bureau conducted research in fiscal 1958 in other important areas in which coal is now being or could be used: Use of lignite for fuel and chemicals, the separation and identification of low-temperature tar components and their subsequent processing into more valuable chemicals, and the upgrading of tars produced by the low-temperature carbonization of bituminous coal.

Bituminous Coal Economics and Statistics

The production of bituminous coal and lignite in fiscal 1958 declined 13 percent below that for the previous fiscal year. Correspondingly, declines in most classifications of coal consumption, including electric power utilities and coke ovens, resulted in an 8 percent drop in total consumption.



This chart depicts Federal industry studies of electric energy sources in the United States for 1900-57 and forecasts probable sources for the period 1958-80.

In addition to the slowdown in business activity, coal exports dropped substantially and some losses to competitive energy sources continued.

Comprehensive information on coal mines and coke plants was prepared as guides for solid-fuels mobilization requirements, particularly regarding regional coal availabilities and coking coal and coke productive capacities as related to steel production and other important uses for coal.

A new program for assembling and publishing figures on marketing and distributing bituminous coal and lignite was adopted. The procedure will provide Government, industry, and business with up-to-date information for appraising the position of coal in the Nation's industrial economy and in the changing pattern of fuel consumption. Related projects are planned to expand studies on the economy of coal production, exports, and uses.

Explosives and Explosions

The Bureau continued safety testing of explosives, blasting devices, and related materials. Approximately 4,000 tests were made; about 8 percent of the explosives examined for permissibility failed to meet standards, and the corresponding manufacturer's lots, declared non-permissible (unsafe), were removed from market. One new stemming device was approved by Bureau examiners. Complaints from neighbors of disturbance coming from one of the testing galleries resulted in the installation of an elbow to divert most of the blast upward.

A systematic study was begun on the general technology of sensitized fertilizer-grade ammonium nitrate compositions and their use in open-pit blasting. Research on the safe handling of hazardous materials included investigations of molten titanium and zirconium nitromethane, rocket fuels, propellants, hydrogen peroxide, and many other industrial chemicals.

Fundamental studies of explosions included initiation of detonations of solid explosives and propellants, and investigations of electrical and magnetic effects that accompany detonations.

The ignition of flammable mine atmospheres by explosives was studied under both simulated and actual conditions. Quenching coal-mine fires by flooding with high-expansion foam was tested in the Bureau's Experimental Coal Mine. Several adhesive compositions that were applied to mine rib and roof surfaces for neutralizing the fire hazard of deposited float coal dust were evaluated. The flammability of 85 industrial dusts and powders was determined in the laboratory.



of ribs, and floor of this gallery in one of the Bureau of Mines Experimental Coal Mines are aflame before a test of the "foam plug" technique for controlling coal-mine fires.

Flammability characteristics also were determined for several gases and liquids, and research was conducted on the causes of occasional fires and explosions in loading tankers using liquid fuels.

The Bureau's long-range fundamental research on flame and combustion processes continued to provide valuable information to the armed services and industry.

Pollution

In cooperation with the Public Health Service under Public Law 78-401 of the 84th Congress, the Bureau of Mines conducted four research projects to develop information needed for controlling pollution of the atmosphere. The projects dealt with: Incineration of combustible wastes, removal of sulfur dioxide from flue gas, analysis of automotive exhaust gases, and removal of air contaminants by catalytic oxidation. Experience and equipment developed by the Bureau over many

years have been used in each project. Information developed on the subjects was released to the public through presentations at technical meetings and articles in technical journals.

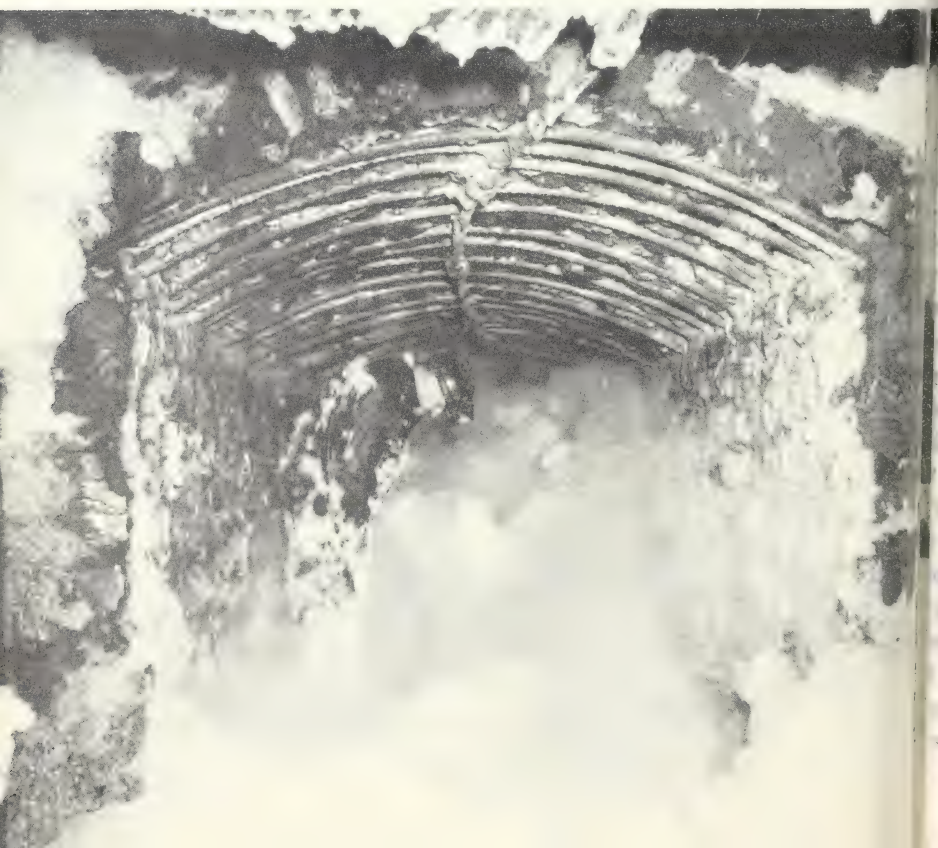
ANTHRACITE

Anthracite Research

The Bureau's research program on anthracite progressed significantly during the year toward developing new uses and preparatory techniques and improving mining methods to increase productivity.

Investigations on the uses of anthracite centered on development of an anthracite metallurgical fuel. Calcination characteristics of coals from various fields were studied in pilot equipment at the Anthracite Experiment Station. The Bureau found that anthracite with the lowest volatile matter generally broke up least during heat treatment. Calcined anthracite produced in the Bureau's pilot equipment was tested satisfactorily in foundry cupolas of mining companies.

Same gallery 30 minutes after the test. Flames have been subdued by a massive "plug" of high-expansion foam sent along the mine entry.



ies. Lengthier tests will be made in a merchant foundry to determine the operating problems that may be involved in commercial operations.

Studies on the performance of small industrial stokers using anthracite as fuel included American Society for Testing Materials tests of 4 stokers in the 100- to 400-pound-per-hour class.

Laboratory studies of agglomerated anthracite fuel produced under a program showed that calcined briquets containing 82 percent anthracite, 10 percent bituminous coal, and 8 percent pitch resist impact and abrasion better than premium-quality coke. These briquets will be tested further in a commercial-size metallurgical operation to obtain information on actual furnace performance. A pilot plant capable of producing 1 to 2 tons of briquets per hour is scheduled for completion at year's end.

A report describing results obtained in testing Pennsylvania anthracite in a Lurgi pressure gasifier in Germany was prepared for publication. Trials demonstrated that Chestnut-size anthracite and Buckwheat-Rice mixture could be gasified satisfactorily at elevated pressure in a fixed bed with oxygen and steam.

Research was begun during the year on generating electricity directly in a fuel cell. The principles and construction features common to the many different types of such cells were given critical appraisal.

Pilot-plant studies began in cleaning and separating the entire range of anthracite sizes. Other coal-preparation projects included study of the effect of size on ash content and the production of ultra-fine anthracite, using an air-swept, conical ball mill.

A project was begun to develop a hydraulic hoisting system for conveying anthracite from mine to surface. Corollary studies were made to develop information on pipe diameters, specific gravities, velocities, and frictional losses.

Research to develop a highly productive system of mechanical mining for anthracite beds of moderate thickness and pitch, a long-range plan was established with a conventional cutting machine and a rigid blade planer in a cooperating anthracite company mine. After further development the Bureau's experimental vibrating-blade miner will be tested. Another type of continuous mining machine, also a drum cutter-loader, will be tried in the same mine.

In cooperation with another anthracite-producing company, the Bureau will conduct research on large-diameter boring equipment for gas and coal extraction and mine development.

Under the Federal-State program for controlling mine water in the Pennsylvania anthracite region, four new projects with an estimated cost of \$11½ million were examined for conformity with the

requirements of Public Law 162. Favorable Bureau reports led to approval of the projects by the Secretary of the Interior and signing of contribution contracts for an estimated \$700,000 in Federal funds.

The first project completed was stream-bed improvement to reduce infiltration into an underlying active mine nearly 200 million gallons annually. At year's end, 2 additional surface-improvement projects and 1 pump project had been completed and were being inspected and tested. Construction and purchase contracts let during the year totaled nearly \$3 million, to be shared equally by the Federal and State Governments. Twelve proposed projects with an estimated cost of more than \$6 million were being prepared by the States for submittal to the Secretary.

During the year, weekly and monthly reports were issued on estimated production, distribution, and stocks of anthracite, wholesale mine prices, hours and earnings, and other information. Detailed annual reports by the Bureau on production, employment, and distribution also provided reliable information to industry and others concerned with the economic problems of the anthracite industry.

RIVER BASIN ACTIVITIES

Without power and water, minerals and fuels remain in the ground. Low-cost hydroelectric power, adequate processing water of suitable quality, and the usability of inland waterways are as vital to the mineral industry as to any other.

The Bureau made many special reports in fiscal 1958 on the mineral industry in proposed Federal and non-Federal water and hydroelectric power project areas, including 10 for the Upper Colorado River Basin. Mineral-engineering consulting services were supplied on water conservation programs, land withdrawals for special water uses, and the Department's manual for watershed protection.

Investigations and reviews of reports for other Federal agencies included 42 for the Department of Agriculture, 26 for the Federal Power Commission, 26 for the Corps of Engineers, 5 for the Bureau of Reclamation, and 1 for the Bureau of Indian Affairs.

With the hope of releasing potable waters for other uses, studies were in progress to determine how low a quality of water can be tolerated in certain metallurgical processes.

Missouri Basin Project

In the Missouri Basin, the Bureau evaluated mineral and mineral-fuel resources, their mining and processing problems, and their potentialities in relation to proposed power and water development.

Administrative planning reports were completed on gypsum in Montana and the mineral resources of the Southwest Missouri coal district. Two others neared completion at year's end.

Cooperating with the Bureau of Reclamation, the Bureau of Mines completed mineral-reconnaissance studies of nine possible reservoir sites, to assure against flooding of important deposits and to permit recovery or protection of any significant minerals found.

A cooperative research project with Reclamation's Lower Cost Canal Lining Committee was accelerated in efforts to reduce the cost of lining irrigation canals and to minimize loss of water by seepage. Deposits of clay, silt, loess, bentonites, and similar materials near irrigation districts (or project units) were sampled for laboratory testing and evaluation as treating agents for canals. Results were encouraging.

An inventory of mineral industrial wastes discharged to ground or surface waters was begun.

In North Dakota the Bureau continued cooperative studies with the Corps of Engineers on the preparation, storage, and pulverization of lime stockpiled at Garrison Dam, where Bureau-developed storage methods have kept 2.5 million tons free from spontaneous combustion.

SPECIAL ECONOMIC STUDIES

The Bureau's economic research during fiscal 1958 was devoted largely to analyzing many programs considered by Congress for aiding the domestic mining industry in a period of declining business activity and falling metal prices. Each program's probable effects on supply, demand, and employment in the mining industry were determined. The effects on mining of such outside factors as gross national product, population, costs, and the general price level also were analyzed. Closely related were analyses of the effects of declining activity in the primary metals on employment, payrolls, and business activity in local communities.

Benefits to the domestic industry of foreign trade—imports as well as exports—were measured.

The costs—real and budgetary—to the Government and to the total economy of stockpiling copper, lead, zinc, and tungsten during 1956 were estimated. Taxation studies were undertaken for nickel, shale oil, and gas. The effects of Federal and State taxation of mineral price surpluses were analyzed. These studies provided background material for developing the Government's long-range and mobilization mineral policies.

A formal report was made on trade activity and consumption in the Great Lakes area of asbestos, bauxite, cement, chromium, coke, copper

ores, fluorspar, gypsum, lead ores, manganese, nickel ore, other ferrous alloys and nonferrous ores, petroleum products, phosphate rock, sulfur, and zinc ore.

A long-range study of the petroleum industry was begun, to include creation of a model for estimating future supply of petroleum from all sources as well as requirements to 1970.

PUBLIC REPORTS

Manuscripts prepared for publication to make the Bureau's findings available to the public and the mineral industries during fiscal 1958 reached a record total of 672, compared with 595 in fiscal 1957. They included 6 bulletins, 291 chapters and 6 bound volumes of *Minerals Yearbook*, 61 reports of investigations, 58 information circulars, 3 papers for technical meetings and journal articles, and 44 miscellaneous publications.

The unusually large number of *Minerals Yearbook* chapters reflected the accelerated program under which the Bureau hopes to issue both chapters and bound volumes in the calendar year following that covered.

Circulation of free Bureau of Mines industry-sponsored 16-mm sound motion pictures reached a new high of 239,069 in fiscal 1958. Group audience attendance of 13,645,601 was virtually the same as in fiscal 1957, and the number of cooperating distributing centers in school systems, public libraries, and colleges increased from 190 to 211.

Although more than 6,000 film prints were in circulation throughout the year, demand continued to exceed supply.

One new color motion picture, "The Copper Network," was added to the Bureau's film library and was placed in circulation throughout the 48 States, Alaska, Hawaii, and the District of Columbia. At year's end, two new films were in production.

ADMINISTRATION SUMMARY

Improvement of administrative services to the research and technical programs of the Bureau was emphasized during fiscal year 1958, with particular attention to better communications and to the development of training programs.

Organization and Management

A Bureau-wide Attitude Survey of Scientific and Engineering Personnel, based on a similar survey by the National Science Foundation, was conducted during the year. Of the 1,206 questionnaires

distributed, over 90 percent were completed and returned. A summary of the results of both surveys was distributed to Bureau scientists, engineers, mathematicians, statisticians, and officials concerned with management improvement. The results were analyzed to identify major problems.

Growing interest in electronic computers led to distribution of a series of Electronic Computer Notes, prepared periodically to keep Bureau's technical personnel informed of developments in and benefits obtainable from electronic computing and data processing equipment.

A basic step in improving the Bureau's communications was taken in conducting Correspondence Management Workshops in the field and Washington offices. The material was organized and prepared by the General Services Administration. Some 320 employees in the Washington Office (grades GS-7 through GS-15, and others who receive or sign correspondence) completed the course during the year. A 4-day conference for personnel concerned with administration in the field and at Washington was held in Albany, Oreg. General training sessions and afternoon workshops provided a comprehensive program.

The activities and regions continuously accomplished management improvements, some of which resulted in minor organizational changes. Significant improvements of the year are reflected in the sections that follow.

Property

The Bureau's property records show the following totals, including land, buildings, equipment, appliances, and vehicles:

| | |
|------------------------|-------------------|
| Region I..... | \$3, 419, 424. 40 |
| Region II..... | 4, 045, 301. 99 |
| Region III..... | 9, 137, 752. 98 |
| Region IV..... | 2, 560, 774. 68 |
| Region V..... | 18, 665, 314. 46 |
| Region activity..... | 19, 789, 896. 30 |
| Washington office..... | 2, 302, 023. 48 |
| Health and safety..... | 1, 153, 470. 87 |
| Total..... | 61, 073, 959. 16 |

This total is \$1,104,116.31 more than at the end of the preceding year.

The year brought steady progress toward simplifying property record keeping, especially in inventory management. As a result, the Bureau of Mines is in better condition than ever before in its responsibility for property management.

Finance

During fiscal 1958, continued effort was made to improve financial activities as a management aid. Our accounting system provided information required by new regulations for reporting accrued expenditures and applied costs, giving complete information on resources, liabilities, and cost of operations.

Bureau of Mines funds, including direct appropriations, prior balances, reimbursements, advances and transfers from other Government agencies, helium operations, and contributions from non-Government sources totaled \$57,778,355. Of this, \$41,665,995 was obligated, leaving an unobligated balance of \$16,112,360.

Funds available and obligations incurred, by source, fiscal year 1958

| | Funds available | Obligations incurred |
|---|-----------------|----------------------|
| Conservation and development of mineral resources | \$20,091,651 | \$19,786,044 |
| Health and safety | 6,222,610 | 6,222,610 |
| Construction | 1,266,835 | 1,266,835 |
| General administrative expenses | 1,148,518 | 1,148,518 |
| Anthracite mine drainage | 8,171,355 | 8,171,355 |
| Consolidated working funds | 2,540,017 | 2,540,017 |
| Transfer appropriation accounts | 3,756,017 | 3,756,017 |
| Contributions from non-Government sources | 1,016,943 | 1,016,943 |
| Helium operations | 13,564,409 | 13,564,409 |
| Total | 57,778,355 | 41,665,995 |

¹ Accrued expenditures.

Personnel

Manual.—Nine chapters of the Personnel part of the Administrative Series, Bureau of Mines Manual were written or revised. Subjects concerned policies and procedural instructions.

Staffing.—Copies of the new Bureau of Mines recruiting brochure were distributed to more than 130 colleges and universities. A training and promotion agreement for engineering and scientific graduate students was prepared and was submitted to the United States Civil Service Commission for approval. A recommendation for increased minimum rates for technologist (minerals) also was submitted to the Commission.

About 40 students were given temporary summer employment in the Washington Office, including many who had worked for the Bureau in previous summers.

Safety.—The Bureau was awarded a Green Cross for Safety for February 1958 for the greatest improvement in safety in the department. Two publications were issued, Employees' Accident-Prevention Handbook and How to Help the Injured Employee. The Bureau participated in a conference in Chicago in conjunction with the Department Safety Meeting and the National Safety Congress.

Employee Relations.—A periodic personnel bulletin was started for tabulating information pertinent to personnel and other matters. The Bureau assisted in improving the Government's employee-relations programs.

Classification.—Field trips were made to eight field stations. Training was provided in classification and employee development to the Personnel Officer of Region IV. One Washington Office classifier attended a Civil Service Commission classification conference in Pittsburgh, Pa. Several instructions and guides were issued, and the Bureau of Mines supplemental information and options for a geologist, GS-1390-0, were provided the United States Civil Service Commission.

Records and Reports.—Personnel statistics were transferred to special cards for machine tabulation.

Board of United States Civil Service Examiners for the Bureau of Mines.—During the year, 77 certificates and 7 Civil Service Commission Forms 303 were issued. A summary of the Washington Field activities for fiscal 1958 follows: Active registers, 118; examinations announced, 2; applications received, 1,126; applications rated, 33; applications rated eligible, 277; and placements, 37.

In all, 750 applications were received for the first written examination for coal-mine inspectors, and 505 of these applicants took the written test. Approximately 20 percent passed.

Schedule and number of paid employees

| | GS | Ungraded | Total |
|-------------------|-------|----------|-------|
| Professional..... | 646 | | 646 |
| Technical..... | 2,920 | 904 | 3,824 |
| Total..... | 3,566 | 904 | 4,470 |

Incentive Awards.—Employee participation in the incentive awards program is reflected by the following tabulation:

| | |
|---|----------|
| Suggestions received during the year..... | 752 |
| Suggestions adopted..... | 263 |
| Cash awards granted for adopted suggestions..... | \$6,750 |
| Suggestions resulting in estimated annual saving..... | 45 |
| Suggestions resulting in intangible saving..... | 218 |
| Total estimated annual saving realized from adopted suggestions and superior performance..... | \$44,995 |
| Superior performance awards granted..... | 76 |
| Cash awards granted for superior performance..... | \$18,200 |
| Special service awards granted..... | 5 |
| Cash awards granted for special service awards..... | \$2,250 |
| Honorary Awards granted..... | 52 |
| Length-of-service awards granted..... | 2,190 |

OFFICE OF OIL AND GAS

Capt. Matthew V. Carson, Jr. (USN), *Director*



THE OFFICE OF OIL AND GAS discharges its duties and responsibilities with a view to the conservation of the Nation's petroleum and gas resources and the achievement of national security for the resources and their products.

The Office of Oil and Gas group of executive and technical experts in petroleum production, refining, transportation, storage, and transmission and distribution, and programing, have kept abreast of the oil and gas situation in both the domestic and foreign fields to meet the basic responsibilities of providing advice and assistance to the Secretary of the Interior, the Assistant Secretary for Mineral Resources, and interested Federal agencies in the development, coordination, and management of petroleum and gas functions authorized by law. Office of Oil and Gas activities of the fiscal year 1958 include the following:

LONG-RANGE PETROLEUM STUDY

Factual background upon which to base a long-range national security policy on petroleum resources and supply is being developed at the request of the Office of Defense Mobilization. Framework for this long-range study has been outlined by the Office of Oil and Gas. It will cover the years 1960, 1965, and 1975, and will include an evaluation of the potentialities of United States petroleum reserves and productive capacity, trends, and projections for consumption and use of petroleum and its products, as well as consideration of potential substitute fuels and use of nuclear energy.

The Office of Oil and Gas, Bureau of Mines, and Geological Survey are participating in this extensive study, together with industry consultants selected by ODM.

VOLUNTARY OIL IMPORT PROGRAM

President Eisenhower established a Special Cabinet Committee in 1957, to make an investigation to determine whether crude oil is being imported into the United States in such quantities as to threaten to impair the national security.

The Committee made its findings and recommended a plan for individual voluntary reduction of crude oil imports which was approved by the President on July 29, 1957, directing the Secretary of the Interior and the Director of ODM to put them into effect. The Secretary of the Interior immediately appointed Capt. M. V. Carson, USN, as his Special Assistant to administer the program.

During the year, the Administrator of the Voluntary Oil Import Program has relied upon the OOG staff for technical advice and statistical services, and has utilized the OOG funds and administrative services to carry out the program.

ASSISTANCE TO CONGRESS

The effect of proposed legislation on Government programs and operations involving petroleum and gas was studied in the Office of Oil and Gas, and information was developed for the departmental reports to the various congressional committees. Numerous requests were answered from Members of Congress for petroleum and gas information for use by them or their constituents. Reports were compiled regularly during the year for the Joint Committee on Defense Production to keep the Committee posted on the agency's operations under the Defense Production Act and related civil defense activities.

COOPERATION WITH STATES

Many States have developed plans for survival in event of nuclear attack on the United States. Under the Federal Civil Defense Administration delegation, the Office of Oil and Gas is responsible for taking action to organize and plan for the solution of oil and gas supply problems in an emergency. By reviewing their plans, OOG acquired knowledge of the States' petroleum and gas planning to meet civil defense emergency. State civil defense officials have also been in consultation with the OOG technical staff to obtain advice and coordinate State and Federal planning.

As the Department's official representative, the Director of the Office of Oil and Gas attended Interstate Oil Compact Commission meetings and kept the participants informed of petroleum and gas developments and items of mutual interest. Liaison has also been

maintained with the oil and gas producing States by direct contact with their regulatory bodies and conservation agencies.

COOPERATION WITH FOREIGN GOVERNMENT

Petroleum advisers to the United States Delegation at the North Atlantic Treaty Organization's Petroleum Planning Committee meetings were provided by the Office of Oil and Gas. An assistant director of OOG serves as chairman of the Working Group, which carries on the technical studies for the PPC. OOG also participated in the development of these NATO petroleum studies.

The Office of Oil and Gas and the Department of State work jointly with various foreign governments on worldwide petroleum supply problems. Technical advice and assistance was also furnished to the United States Delegation to the Oil Committee of the Organization for European Economic Cooperation.

EXPANSION GOALS AND ACCELERATED TAX AMORTIZATION

The Office of Defense Mobilization closed the last two remaining industrial expansion goals on March 31, 1958, under which projects of the petroleum and gas industries could be considered for accelerated tax amortization under the Internal Revenue Code. Seven new applications for rapid tax amortization and a number of requests for postcertification actions on certificates of necessity for accelerated tax amortization that had been issued by ODM were analyzed by OOG during the year and reports and recommendations were submitted to ODM.

SERVICE TO THE PUBLIC

Secretary of the Interior Fred A. Seaton, the Assistant Secretary for Mineral Resources, and the Director of the Office of Oil and Gas strive to promote better public understanding of Government action. They have appeared before many civic and industry groups around the country and have held press conferences to give facts and information regarding the Government's position and actions in petroleum and gas administration.

INDUSTRY ASSISTANCE

Channels of communication with industry established by the Secretary of the Interior, prior to the period covered by this report, which were available to advise and assist the Office of Oil and Gas

the National Petroleum Council, Foreign Petroleum Supply Committee, and the Military Petroleum Advisory Board.

Through the National Petroleum Council of 104 leaders in the oil and gas industries, OOG received five reports on studies that were made at the request of Government. The reports were on (a) productive capacity of the United States for crude oil and natural gas, (b) the above ground storage capacity in this country for crude oil and the four principal petroleum products, (c) the productive capacity for liquefied petroleum gases, (d) United States refining capacity by principal refining areas, and (e) United States petroleum transportation capacity, by pipelines, railroad tank cars, tank trucks, and river barges, and lake tankers. For the petroleum transportation study alone, a main committee and five subcommittees in which industry specialists participated were required to carry out this assignment from the Director of the Office of Oil and Gas. As of June 30, NPC had completed all of its assignments in response to written requests of the Director of the Office of Oil and Gas.

The Foreign Petroleum Supply Committee, composed of American companies engaged in foreign petroleum operations, was established under the Voluntary Agreement Relating to Foreign Petroleum Supply, as amended May 8, 1956, pursuant to section 708 of the Defense Production Act.

While the Foreign Petroleum Supply Committee was not convened during this fiscal year, the Office of Oil and Gas made periodic reviews of the situation concerning the operation of this agreement. Following the last review for this fiscal year, the Secretary of the Interior advised the Attorney General on May 9, 1958, that this agreement constitutes the best method available to carry out a program for meeting an emergency that may seriously affect the petroleum supply of the free world and, in view of world conditions, the agreement should continue in force. This continuation was approved by the Attorney General.

At the request of the Departments of Interior and Defense, the Military Petroleum Advisory Board has been engaged in making a worldwide wartime petroleum and gas supply-demand study using strategic assumptions furnished by the Department of Defense. The Board is assisted by a number of panels and committees of experts experienced in all phases of the petroleum and gas industries operations.

Through the information and advice that has been furnished to the departments and independent agencies of Government, analyses, studies, and reports prepared for them, and participation in inter-agency committee work, the Office of Oil and Gas has served as a focal point for information and leadership in governmental petroleum activities.

DEFENSE MINERALS EXPLORATION ADMINISTRATION

C. O. Mittendorf, *Administrator*



The Defense Minerals Exploration Administration continued to assist private industry in the exploration for domestic sources of strategic and critical minerals and metals during the fiscal 1958. This program, authorized and financed under the Defense Production Act of 1950, ended on June 30, 1958, and on June 6, 1958, DMEA announced that funds to finance new exploration contracts would not be available after June 30. Contracts in effect on June 30 were continued until terminated in accordance with contract provisions. Effective on June 6, 1958, the Federal Government's financial commitment was not increased in any contract where results to date had progressed to a point at which a certification of discovery or development could be issued. New applications were accepted until June 30 and those on which action could not be completed by that date were held as pending cases.

New Program Approved

The long range minerals program proposed in April 1957, by the Secretary of the Interior included continued exploration assistance similar to that provided by DMEA. During the year, several bills were introduced in the Senate, including Senate 3817, which authorized the Secretary to establish and maintain a permanent domestic program of exploration assistance to private industry. This legislation will allow new application, subsequently enacted, proceeding under the rules and regulations established for the new program.

ADMINISTRATION OF DMEA

From mid-1951 until June 30, 1958, DMEA operated pursuant to authority delegated to the Secretary of the Interior by the Office of

Defense Mobilization under the Defense Production Act of 1950, amended. Under the exploration program, DMEA assisted private enterprise in an intensive search for minerals and metals vital to the National Defense by paying 50 or 75 percent of the allowable costs of the exploration work, depending upon the minerals sought. Prior to March 23, 1954, the Government contributed 90 percent of the cost for some minerals.

Exploration projects were established by contracts with operators which specified the work to be done, the project area, allowable costs, dates for starting and completing the work, total cost of the work under the contract, and the Government's share of this total. The contracts also provided for repayment of the Government's contribution without interest by a royalty on production. If there was no production, there was no obligation to repay. Royalty payments were required on all production from the property described in the contract from the date of the contract until 6 months after receipt of the operator's final report. Royalty payments were also required on any production from the property after completion of exploration work if, in the opinion of the Government, the work was successful in finding ore. In this case certification of discovery and development was issued, and the operator, or his successor in interest, was required to pay royalty on all production from the date of the contract until a specified period (usually 10 years) had elapsed or the amount of the Government's contribution had been paid in full, whichever occurred first. The royalty rate ranged from 1½ to 5 percent of sales receipts.

DMEA employed a small staff in the Washington Office and four auditors to administer the 1958 program. Administrative services available from the Office of the Secretary and the Solicitor's Office of the Department were utilized in the program. The staffs and facilities of the Bureau of Mines and the Geological Survey were used to administer the program in the field.

On October 23, 1957, DMEA Order 1 was revised to incorporate several amendments including recommendations of the Borrowing Priority Review Board of ODM to reduce the rate of Government participation in the allowable costs of certain commodities. The following mineral commodities were changed from 75 to 50 percent Government participation: Asbestos (chrysotile only), columbium, tantalum, diamonds (industrial), kyanite (strategic), mercury, molybdenite and rare earths, platinum group metals, quartz crystals (piezo-electric), tantalum, thorium, tin, tungsten, and uranium. Other commodities which were eligible for 50 percent Government participation are—bauxite, cadmium, chromium, copper, fluor spar, graphite (crucible flake), lead, molybdenum, and zinc. The follow-

ing commodities remained eligible for 75 percent Government participation: Antimony, beryl, cobalt, manganese, mica (strategic), ni rutile-brookite, selenium, and talc (block steatite). The pamphlet titled "The Defense Minerals Exploration Program" was changed to conform with the new regulations.

Audits

By the close of the fiscal year, approximately 86 percent of exploration contract disbursements had been audited. The details of the audit program are shown in the following table:

Audit summary

| | Fiscal 1958 | Program to June 30, 1958 |
|---|---------------|--------------------------|
| Cost audits: | | |
| Number of audits..... | 134 | |
| Number of projects audited..... | 109 | |
| Costs claimed by operators..... | \$5, 086, 349 | \$30, 000, 000 |
| Disbursement certified for payment..... | \$3, 131, 731 | \$21, 000, 000 |
| Royalty audits: | | |
| Number of audits..... | 63 | |
| Number of projects audited..... | 37 | |
| Production subject to royalty..... | \$7, 273, 801 | \$28, 000, 000 |
| Amount royalty due (including that paid)..... | \$366, 818 | \$1, 000, 000 |

SUMMARY OF DMEA OPERATIONS

DMEA operations for the fiscal year 1958, and for the entire program are summarized under the headings below.

Applications

Applications were received during the fiscal year from 25 States and Alaska proposing exploration projects for 22 different commodities. For the entire program applications have originated in the States and Alaska covering 37 commodities. Actions taken on applications are shown in the following tabulation:

Application summary

| Action | Fiscal 1958 | Program to June 30, 1958 |
|-----------------------------------|-------------|--------------------------|
| Received..... | 303 | |
| Contracts executed..... | 121 | |
| Denied..... | 179 | |
| Withdrawn..... | 54 | |
| Action pending June 30, 1958..... | 104 | |

Contracts

The 121 new contracts executed during fiscal 1958 were for projects in 19 States and Alaska and covered explorations for 14 different commodities. For the entire program there have been DMEA projects in 34 States and Alaska searching for 30 different commodities. The summary of contract actions for fiscal 1958, and for the entire program is given in Table 1.—Contract summary attached.

Certifications

DMEA issued 38 certifications of discovery or development in fiscal 1958, bringing the total of certifications for the program to 337. (See Table I, Contract Summary, for dollar figures relating to certifications.) Certifications have been issued covering projects located in 37 States and Alaska and involving the search for 25 mineral commodities as shown in Table II attached.

Potential and Royalties

On a conservative basis using prices in effect at the end of the fiscal year, the recoverable minerals and metals found in the 337 certified projects are estimated to have a gross value of \$470,000,000. Substantially more showings have been reported on 23 other projects which may eventually lead to their certification.

Royalties collected incident to the sale of material found under DMEA contracts continued at a relatively high rate in fiscal 1958. Forty-four operators have repaid in full the sums advanced to them under their DMEA contracts, namely, \$666,975.

Royalty summary

| Type of project paying | Fiscal 1958 | | Program through June 30, 1958 | |
|--|-------------|--------------------|----------------------------------|--------------------|
| | No. | Amount received | No. | Amount received |
| Discovered (as discovery or development)..... | 98 | \$482,560 | 243 | \$2,156,554 |
| Leasehold agreement (qualified certification)..... | 11 | 6,605 | 18 | 13,046 |
| Certified (obligation to pay derives from the contract)... | 36 | 130,122 | 107 | 336,634 |
| Total..... | 145 | 619,287 | 368 | 2,506,233 |

The Role of Small Business

The small mine operator continued in fiscal 1958 to maintain predominant position numerically in the DMEA program. About 43 percent of all contracts called for expenditures of less than \$3,000 by the operator, and approximately 60 percent of all contracts provided for expenditures of less than \$25,000. The distribution of contracts according to size is shown in the following tabulation:

Distribution of DMEA contracts by size (as of June 30, 1958)

| Size of contract | Total estimated cost | | Number of contracts | |
|----------------------------------|----------------------|---------|---------------------|---------|
| | Dollars | Percent | Number | Percent |
| Less than \$25,000..... | \$6,843,447 | 12.0 | 682 | |
| \$25,000 through \$49,999..... | 6,509,960 | 11.5 | 187 | |
| \$50,000 through \$74,999..... | 5,946,286 | 10.5 | 97 | |
| \$75,000 through \$99,999..... | 5,039,561 | 8.9 | 58 | |
| \$100,000 through \$199,999..... | 10,971,790 | 19.3 | 84 | |
| \$200,000 and over..... | 21,487,067 | 37.8 | 51 | |
| Total..... | 56,798,111 | 100.0 | 1,159 | 100.0 |

TABLE 1.—Contract summary

| | Fiscal 1958 | | | Program through June 30, 1958 | | | |
|---|-------------|------------------------|--------------------------|-------------------------------|-----------------------|--------------------------|---------------------------------------|
| | No. | Total estimated costs | Government participation | No. | Total estimated costs | Government participation | Government participation expenditures |
| Contracts as originally executed..... | 121 | \$5,778,626 | \$3,496,937 | 1159 | \$50,547,489 | \$31,056,412 | |
| Amendments (which changed contract amounts)..... | 21 | 729,333 | 392,657 | 215 | 6,250,622 | 3,764,657 | |
| Contracts plus amendments (net)..... | | 6,507,959 | 3,889,594 | | 56,798,111 | 34,821,069 | \$21,287,879 |
| Projects certified as discoveries..... | 38 | ¹ 3,675,722 | ¹ 2,264,794 | ² 337 | 21,811,621 | 13,690,228 | 11,039,875 |
| Projects terminated without certification..... | 94 | 3,908,283 | 2,431,241 | 597 | 17,484,980 | 10,936,236 | 6,218,744 |
| Contracts canceled without Government expenditure..... | 7 | 149,537 | 103,708 | 71 | 1,919,622 | 1,181,851 | |
| Contracts in force as of June 30, 1958 not certified..... | | | | 154 | 15,581,888 | 9,012,754 | 3,960,800 |

¹ These figures do not include amendments executed in fiscal 1958 to contracts previously certified.

² Includes 16 projects in force and certified bringing the total for contracts in force to 170. Also included are figures relating to 2 projects which were certified though canceled, i. e., no Government funds were spent.

TABLE 2.—DMEA projects certified—Distribution by State and commodity—As of June 30, 1958

| | Antimony | Asbestos | Beryl-Mica | Chromium | Cobalt-Nickel | Columbium-Tantalum | Copper | Corundum | Fluorspar | Iron | Lead-Zinc | Lead-Zinc-Copper | Manganese | Mercury | Mica | Monazite | Rutile | Sulphur | Tale | Thorium | Tin | Tungsten | Uranium | Total |
|----------------|----------|----------|------------|----------|---------------|--------------------|--------|----------|-----------|------|-----------|------------------|-----------|---------|------|----------|--------|---------|------|---------|-----|----------|---------|-------|
| Alabama | 2 | | | | | | | | | 1 | | | | 1 | 2 | | | | | | 2 | | | 3 |
| Alaska | | | | | | | | | | | 3 | 2 | | 1 | | | | | | | | 1 | | 6 |
| Arizona | | 3 | | | | 4 | | | | | | | | 1 | | | | | | | | 3 | | 16 |
| Arkansas | | | | | | | | | | | | | 2 | | | | | | | | | | | 2 |
| California | | | | 1 | | | 1 | | | 1 | 1 | 3 | 1 | 6 | | | | | | 2 | | 8 | 1 | 23 |
| Colorado | | | 2 | | | | | | 1 | | *10 | 1 | | | | | | | | | | 11 | 19 | 46 |
| Florida | | | | | | | | | | | | | | | | | 1 | | | | | | | 1 |
| Georgia | | | 1 | | | | | | | | 13 | 2 | 1 | | 3 | | | | | | | 4 | | 5 |
| Idaho | 1 | | | | 2 | 1 | 1 | | | | | | | | 1 | 3 | | | | | | | | 1 |
| Illinois | | | | | | | | 3 | | | 1 | | | | | | | | | | | | | 3 |
| Iowa | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Maine | | | *1 | | | | | | | | | | | | | | | | | | | | | 1 |
| Michigan | | | | | | 1 | | | | | | | | | | | | | | | | | | 1 |
| Missouri | | | | | 1 | | | | | | 2 | 1 | 3 | | | | | | | | | | | 3 |
| Montana | | | | | | 1 | 1 | 1 | | | 4 | 1 | 1 | 1 | 1 | | | | | | | 6 | 1 | 17 |
| Nevada | | | | | | | | | 1 | | 3 | | 1 | 1 | | | | | | | | 14 | | 22 |
| New Hampshire | | | | | | | | | | | | | | | 1 | | | | | | | | | 1 |
| New Jersey | | | | | | 1 | | | | 1 | | | | | | | | | | | | | | 1 |
| New Mexico | | | | | | | 2 | | | | 2 | | | | | | | | 1 | | | | 5 | 9 |
| North Carolina | | | | | | | | | | | | | | 2 | 57 | | | | | | | | | 59 |
| Oregon | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| South Carolina | | | | | | | | | | | | | | | | 1 | | | | | | | | 1 |
| South Dakota | | | 5 | | | | 1 | | | 1 | 1 | | | | 1 | | | | | | | 1 | 1 | 8 |
| Tennessee | | | | | | | | | | | 1 | | | | | | | | | | | | | 1 |
| Texas | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 |
| Utah | | | | | | 1 | | 1 | | | 9 | 1 | | | | | | | | | | 4 | 28 | 44 |
| Vermont | | 1 | | | | 1 | | | | | | | | | | | | | | | | | | 2 |
| Virginia | | | | | | | | | | | | | 1 | | | | | | | | | | | 2 |
| Washington | 1 | | | | | | 2 | | | | 6 | 1 | | | | | | | | | | 1 | 1 | 12 |
| Wisconsin | | | | | | | | | | | 10 | | | | | | | | | | | | | 10 |
| Wyoming | | | | | | | | | | | | | | | | | | 1 | | | | | 5 | 6 |
| Total | 4 | 4 | 9 | 1 | 3 | 2 | 15 | 1 | 6 | 3 | 66 | 12 | 9 | 12 | 66 | 4 | 1 | 1 | 1 | 2 | 2 | 52 | 61 | 337 |

*Two "canceled" projects were certified even though no Government money was spent.

OFFICE OF MINERALS MOBILIZATION

Spencer S. Shannon, *Director*



THE OFFICE OF MINERALS MOBILIZATION was established in January 1955 to carry out the responsibilities of the Secretary of the Interior for national defense preparedness in minerals, metals, and solid fuels delegated to him by the Office of Defense Mobilization.

FCDA Delegation No. 3 dated August 26, 1955, delegated to OM the responsibility for planning and directing a program designed to assure procurement, transportation, and distribution of adequate solid fuels supplies to attacked areas and reception centers.

During the past year, the Office maintained constant surveillance of the ability of the Nation to meet estimated national defense emergency requirements for the 85 strategic minerals, metals, and solid fuels from domestic wartime production, from wartime imports, and from the Government stockpiles.

In cooperation with the Bureau of Mines and the Geological Survey, the Office evaluated changes in markets, prices, production, reserves, and productive capacity to insure that the Nation would maintain an adequate domestic production component of the mobilization base for strategic metals, minerals, and solid fuels. Special attention was given to those strategic metals and minerals for which Government programs are in effect, and to strategic materials which are experiencing market difficulties.

Notable among the materials requiring special attention were beryllium, columbium-tantalum, copper, metallurgical chromite, lead, zinc, fluor spar, and tungsten. Other special studies were made on copper, bismuth and nickel. New comprehensive mobilization base evaluations or reviews were completed on selenium, quartz crystals, diamonds, tin, platinum group metals, titanium metals, celestine

ium, talc, rare earths, bauxite, manganese-metallurgical grade, tungsten, iron ore, and mica.

To estimate the availability of imports of strategic minerals under various defense conditions, the Office evaluated the effects of current changes in foreign capacity and production on which this Nation could, in some emergency situations, be dependent.

With respect to stockpiling of metals and minerals, the Office maintained a watch on the size and nature of the strategic stockpile and Defense Production Act inventories in relation to estimated wartime requirements. Independent evaluations were made and the Office engaged in interagency consultations on questions of disposals of excess and sub-specification materials, beneficiation and further processing of inventories, specification and packaging changes, new purchase and transfer authorizations and further industrial production expansion and maintenance of existing production capacity in metals and minerals.

Special work was undertaken by the Office for the Special Stockpiling Advisory Committee, and subsequently with OCDM and other agencies in evaluating its recommendations. The policy reexamination culminated in the announcement by the Director of the OCDM of a revision of the policy for stockpiling strategic and critical materials.

The Supplemental Stockpile acquisitions of strategic metals and minerals under the agricultural surplus disposal program and acquisitions under the domestic minerals purchase program required attention by the Office during this year. The Office carried out staff work and consulted with the Department of Agriculture and the OCDM on acquisitions under the agricultural barter program.

Activities with respect to civil defense readiness were intensified during the year. The Office assembled and transmitted to emergency relocation centers essential documents and files to permit continuity of government in the event of emergency. It prepared input data for use in the National Bomb Damage Assessment Center computing machines on damage to metals and minerals facilities and to coke producing facilities.

During fiscal 1957, the Office appointed 21 additional persons from industry to the National Defense Executive Reserve to be available to serve in event of a national emergency. In November, these reservists participated in the National Defense Executive Reserve Conference. During the fiscal year, all of the designated Executive Reservists were briefed on their duties in the event of an emergency. In line with its responsibility to provide guidance to industry for continuity of production during an emergency, the Office prepared a

brochure entitled: "An Alert to the Minerals Industry," which was published and distributed in May 1958.

Additional agreements were negotiated with State Civil Defense Directors as to the programs for emergency distribution of so-called fuels. At the end of the fiscal year, negotiations with five States remained to be completed in the area east of the Mississippi.

OFFICE OF GEOGRAPHY and BOARD ON GEOGRAPHIC NAMES

Walter W. Ristow, *Chairman*

Meredith F. Burrill, *Executive Secretary*



THE INTERDEPARTMENTAL BOARD on Geographic Names was established under Public Law 242, July 25, 1947, entitled "An Act to provide a central authority for standardizing geographic names for the purpose of eliminating duplication in standardizing such names among the Federal departments, and for other purposes." The Office of Geography keeps the records, performs research, and otherwise carries out the conjoint responsibilities of the Secretary of the Interior under the Act.

The Board and Staff of the Office of Geography continued in 1958 to carry out, within the limits of available funds, their responsibilities to standardize geographic nomenclature for use by the Federal Government. Board and Committee meetings were held at frequent intervals for the purpose of extending and revising nomenclature policies and approving individual foreign and domestic names.

A major part of the Staff's effort in 1958 was devoted to the production of a large gazetteer of the U. S. S. R. and associated Soviet-administered areas scheduled for publication in 1959. This gazetteer will contain about 350,000 official standard names and cross-referenced variant names in one alphabetical listing. Gazetteers were produced for Puerto Rico and the Virgin Islands and for Libya, bringing the total of such publications for public sale to 41, containing combined listings of nearly 700,000 names. In the field of domestic names, besides Puerto Rico and the Virgin Islands, more than 600 new or problem names were the subject of formal decision. In 1958 a considerable part of the Staff's effort was diverted from editorial activities to an increased volume of standardized names.

and progress was made in reducing the unit cost of standardizing names by increased streamlining of procedures.

International standardization of names was promoted by the joint adoption by the Board and the Permanent Committee on Geographical Names for British Official Use (PCGN) of transliteration systems for the romanization of Persian and Hebrew. Joint BGN/PCC systems were previously adopted for Russian, Bulgarian and Arabic. In addition, principles were formulated for consideration at international conferences to be held under United Nations auspices, and problems of international standardization were discussed with officials of several foreign Governments.

The Hawaiian Names Advisory Committee and the Alaska Names Advisory Committee were reorganized. The Advisory Committee on Antarctic Names was enlarged and both it and the Advisory Committee on Arabic and Persian continued to perform effectively in their areas of interest.

Office of the Assistant Secretary *Public Land Management*

Roger Ernst, *Assistant Secretary*



THE ASSISTANT SECRETARY for Public Land Management discharges the duties of the Secretary in carrying out the Department's programs in that field, including direction and supervision of the Bureau of Land Management, the Bureau of Indian Affairs, the National Park Service and the Office of Territories.

Each of those organizations accomplished gratifying gains in the past fiscal year, but one event towered tall above the others: Statehood for Alaska. On the final day of fiscal 1958, Congress completed voting to admit the Nation's largest Territory as the 49th State. The Office of Territories could take justifiable pride in its faithful labor under the Administration's guidance in helping to promote Alaska to the point where it was able to gain its rightful rank in the Republic.

As the year began, Alaska's economic outlook brightened dramatically with the news of an oil strike on the Kenai Peninsula. A flood of lease filings followed. The Alaska Public Works Program continued throughout the year to make a major contribution to the future State, providing basic community facilities. The Alaska Railroad, confronted with rising costs and declining revenues, nevertheless succeeded in finishing the year with a net profit.

Hopes were dashed for Statehood for Hawaii in this session of Congress, but the outlook for the next session appears good. The Administration is firmly pledged to work for that goal.

Hawaii's prosperity soared to nearly boom proportions in fiscal 1958, in spite of a costly sugar strike.

Three savage typhoons wrought havoc in the Trust Territory of the Pacific Islands. Economic activity there was high, but much of it necessarily was devoted to repairing storm damage.

Nearly every business index in Guam showed improvement. Employment and wages both increased in American Samoa. Tourist income grew and a start was made on a great international airport. The Virgin Islands enjoyed a record year for tourist income. Unusually heavy rains there in the spring of 1958 brought relief from the preceding summer's drought.

The Bureau of Land Management is responsible for conserving and managing the remaining vacant public domain embracing more than 475 million acres, most of them in Alaska and the 11 Far West States.

During fiscal 1958, new regulations were effected to cover mineral leasing on wildlife lands. They close refuges to all leasing, and on other wildlife lands limit mineral leasing to areas where such development is compatible with wildlife conservation. Stipulations specify full protection for wildlife values, while simultaneously they promote sound use of mineral resources. Steps were taken to open some 20 million acres in far northern Alaska to mining and mineral leases. A program was developed for competitive leasing of about 16,000 acres in the Gubic Gas Field, a known structure, and for noncompetitive leasing on about 4 million acres of adjacent lands.

During the year a new formula was placed in effect for determining public land grazing fees. Based on livestock prices, it increased the fee paid to the United States.

A new public recreational land-use policy was launched, a cooperative program with local, State and Federal Government agencies uniting to expand recreational development on public lands.

The Bureau marketed more than 760 million board feet of timber during the year under a sustained-yield formula. A reforestation program led to the planting of more than 8½ million seedlings on nearly 17,000 acres, and other seedings by hand and airplane on about 9,000 additional acres.

Fire destroyed more than 5 million acres of forest, woodlands, and tundra, much of the tragic loss striking Alaska. But progress was made in creating strong safeguards against future losses; adoption of a systematic Alaska fire patrol, extensive use of chemical fireproofing chemical foam dropped from airplanes on going fires, initiation of a smokejumper program, adoption of a fire-danger rating system.

The National Park Service's 10-year Mission 66 development program, which started July 1, 1956, remained essentially on schedule in fiscal 1958. A total of \$65,701,300 was expended or obligated during the year for 736 construction projects, and private enterprise invested more than \$5,500,000 in visitor accommodations.

The legislative program provided notable results in the form of congressional action. For example, after many years an accepted

boundary was fixed for Everglades National Park. Exchange authority was obtained so that private lands may be acquired in Olympic National Park. Fort Clatsop National Memorial was authorized to be established to commemorate the spanning of the continent by Lewis and Clarke Expedition, and National Park status was made possible for Petrified Forest National Monument.

Eight new visitor centers were completed during the year, and others were improved. The road program provided for 175 miles of new or reconstructed roads, plus 23 miles of national park ways.

National Park Rangers, the dedicated servants who are the backbone of the national park system, performed heroically in 20 major rescue and evacuation operations.

The Canyon Village development in Yellowstone National Park was completed during the year. Similar projects were completed at Colter Bay in Grand Canyon National Park, the Mather Area in Grand Canyon National Park and at Flamingo in Everglades National Park.

Other Mission 66 highlights during the year included completion of the Dinosaur Visitor Center; completed development of James Island, Colonial Parkway and Yorktown for use during the 350th anniversary celebration of the landing of the first town Colonists; completion of Stevens Canyon Road in Mount Rainier, the East Side Road in Grand Teton and the Park Road in Everglades National Park.

The passenger boat to serve Isle Royale National Park, christened June 21.

The Bureau of Indian Affairs continued its emphasis on broadening educational and economic opportunities for the Indian people.

An adult vocational training program was initiated during the year and provided training for 376 persons in regular vocational schools and for 168 others on the job in plants near reservations. Expansion of the adult educational program resulted in units serving a total of 72 communities. Enrollment of school-age children increased to approximately 129,000, with 61 percent of them in public schools. The Bureau provided assistance for more than 500 students in colleges and other higher institutions.

More than 5,700 Indian people during the year were helped to relocate in towns and cities offering better job opportunities.

Indian income from oil and gas leases totaled \$55,210,467, the second highest in history.

Readjustment programs advanced at the Menominee Agency in Wisconsin and the Klamath Agency in Oregon, looking forward to

full independence for tribal groups. Final membership rolls were established. An appraisal of the Klamath tribal property was completed, and slightly more than three-fourths of the tribal members elected to withdraw and receive cash payments for their share. A management plan was drawn up for the residual tribal estate.

Lack of full employment opportunities for Indians increased the need for general assistance.

The Seminole Indians of Florida, for the first time in their history, developed a constitution, corporate charter and bylaws, and elected a tribal council and board of directors. The new tribal organization established a credit program, completed a 7,500-acre improvement lease, acted to stabilize and improve the tribe's 6,000-head catfish herd, and initiated plans for commercial development of a valuable tract 25 miles north of Miami.

Most reservations suffered reductions in timber sales because of the drop in demand in the market.

The Bureau, continuing its policy of building roads up to acceptable standards and transferring them to local governments, reduced the nationwide road system by 606 miles. During the year, road construction obligations were incurred totaling \$14,827,092.

BUREAU OF INDIAN AFFAIRS

Glenn L. Emmons, *Commissioner*

CONTINUING EMPHASIS on the broadening of educational and economic opportunities for Indian people was reflected during 1958 by a number of salient developments by the Bureau of Indian Affairs.

One of the most important was the formal initiation of an adult educational training program under the provisions of Public Law 959 of the 84th Congress. Such training was provided in the period ending June 30, 1958, for 376 Indians enrolled in regularly accredited educational schools and for 168 others on the job in plants near the reservations which had training contracts with the Bureau.

Another major development was the further expansion of the adult education program which was originally launched on five reservations in 1956. By the end of the 1958 fiscal year, adult education classes were serving a total of 72 Indian communities or native villages in the United States and Alaska.

Meanwhile enrollment of Indian children between the ages of 6 and 18 in schools of all types increased from about 125,000 in 1957 to approximately 129,000 in 1958. Enrollment in public schools advanced by about 1,900 students and represented 61 percent of the total. Assistance was provided by the Bureau for over 500 students enrolled in colleges and other higher institutions.

Due to a temporary shortage of Indian job opportunities, the number of Indians receiving assistance in relocation was about 18 percent lower than in 1957 and the backlog of applications for assistance was substantially increased. By the end of the fiscal year, however, scheduling of relocations was resumed at the earlier level and the backlog was reduced. More than 5,700 Indian men, women, and children were assisted to relocate during the fiscal year.

Income to Indian tribal groups and individual Indians from the leasing of their lands for oil and gas development dropped considerably from the record-breaking figure of \$72,616,644 for 1957 but still

reached the second highest level in history at \$55,210,467. Of this amount, more than \$28,000,000 represented bonuses in a single land sale involving lands in the Four Corners portion of the Navajo Reservation.

At the Klamath Agency in Oregon and the Menominee Agency in Wisconsin, where readjustment programs are under way leading to full independence for the tribal groups, several important steps in this direction were taken during the year. Final membership rolls of both tribes were established and published in the Federal Register. At Klamath, an appraisal of the tribal property was completed; slightly over three-fourths of the tribal members elected to withdraw and to receive cash payments for their individual shares of the assets; and a management plan for the residual tribal estate was drawn up by tribal management specialists. A division of the property between withdrawing and remaining members was completed at the very end of the fiscal year.

EDUCATION

Enrollment of Indian children of school age increased 3.3 percent in fiscal 1958 as compared to the preceding year. Of the 130,000 enrolled, 61 percent attended public schools, 30 percent were in Federal schools, and 9 percent in mission and other private schools. Public school enrollment increased by an estimated 1,500 students as a result of Bureau policy to transfer classes and schools from Federal jurisdiction to the public schools whenever conditions are favorable.

As citizens of the States in which they reside, Indian children are entitled to a free education. However, the tax-exempt status of Indian-owned lands and consequent lack of revenue create financial hardship in many school districts with large Indian populations of school age. Contracts negotiated by the Bureau under the Johnson-O'Malley Act (48 Stat. 596) provide the necessary financial aid to assure adequate educational programs in such districts. In 1957, State and local contracts were negotiated with 18 States and the Territory of Alaska. More than 42,000 Indian students were enrolled in districts assisted by Johnson-O'Malley funds.

As new public schools are constructed under the terms of Title I of Public Law 815, as amended, more Indian children will be transferred into them from nearby Federal schools and will receive the benefits of public school education.

Both new construction and expansion of present Federal school facilities are needed, however, to accommodate school-age children now enrolled; to provide for the gradually lengthening average span of attendance by Indian children; and to relieve overcrowding



Enrollment of Indian children in schools throughout the country reached an all-time high total of 130,000 in 1958.

Bureau schools. Long-range projection of school construction has been charted and is adjusted annually as warranted.

In fiscal 1958, the Bureau operated 80 boarding schools and 214 day schools including 23 trailer schools and 1 hogan operation on the Navajo Reservation and 10 instructional aid schools in Alaska. Classes were conducted for student-patients in 3 Public Health Service Indian hospitals, and dormitory facilities were provided for more than 2,900 Indian students who attend the local public schools in communities bordering the Navajo Reservation.

Navajo enrollment is still increasing at a greater rate than the national average although the rate of increase has slowed. In 1958 the rate was 3.8 percent as compared to 6.8 percent in 1957. Of the 20,433 Navajo children, of all ages, enrolled in school, 30.4 percent attended public schools, 62.9 percent attended Federal schools, and 6.7 percent were in mission and other private schools.

Establishment of Standards

A comprehensive statement of standards to govern Federal Indian school operations, developed in fiscal years 1956 and 1957, has been further refined through participation of field personnel. Their suggestions have been incorporated in the document, and these criteria

will be used as a guide to improve operational standards in all Bureau boarding schools.

A survey, made through a testing program in the nonreservation boarding schools, indicated general weakness in reading and communication skills. Emphasis on instruction to overcome this disability will be made through supervisory and in-service training program.

School Appraisals

An evaluation of school management and its relationship to funding was made in selected schools by one team of supervisors. An evaluation of dormitory operation and the relationship of proper standards of staffing and equipment to provide adequate surroundings and experience in maintaining high living standards was made by a second supervisory team. The studies pointed up a need for strengthening instruction in acceptable living standards and personal habits. Such instruction will be emphasized in the next fiscal year.

School Program Evaluation

Pilot school program evaluations begun in 1954 were completed in fiscal 1958. The participation of area teams in the evaluations has equipped them to continue this objective appraisal of their own school programs. Follow-up reports indicate that program improvement is under way as a result of this work.

Studies are being continued for the purpose of maintaining up-to-date standards for the types of schools operated by the Bureau, and formulate standards for activities where none has been established.

Rehabilitation Surveys

Analyses of all maintenance and building needs at four Bureau boarding schools have been completed. These surveys were very thorough and complete, and the resulting reports are being used in the Bureau's long-range plans for construction and rehabilitation.

Reservation Adult Education Program

The adult education program was expanded during 1958 and adult education units now serve 72 different communities at 24 agencies and locations.

The program is characterized by the great variety of instruction activities as dictated by the various needs and interests of the adult and by fundamental differences between the communities. In communities of low educational attainment, instruction centers around

basic English and arithmetic; in other communities, instruction ranges from elementary school subjects to special studies leading toward a certificate equivalent to a high school diploma. Short courses and instruction in traffic laws, law and order, home improvement, budgeting, and similar subjects are available to meet specific requests for training.

Another phase of the local program is directed toward assisting community groups in organizing action programs for the purpose of participating in the civic life of the community and improving relationships with non-Indian groups.

In-Service Education

The areas, responsible for in-service education of personnel at the agency level, held 26 sessions for this purpose in 1958. Approximately 1,300 employees attended these sessions.

In addition to the area workshops, the Central Office sponsored two service-wide conferences for 50 educational specialists and more than 100 adult education program personnel. Servicewide training sessions are required to develop understanding and coordination of servicewide programs and policies.

Publications

Field personnel evinced greater interest in the semimonthly publication, *Indian Education*, in 1958. Of 31 articles published, 15 were contributed by teachers, advisers, principals, superintendents, education specialists, and directors of schools. The Publications Service located at Haskell Institute distributed more than 27,000 copies of publications to Bureau schools and to the general public in 1958.

Scholarship Program

Federal loans, grants, and working scholarships were made to more than 500 Indian students in fiscal 1958. Tribal groups and private organizations and schools established additional scholarship benefits for Indian students. The State of Wisconsin enacted legislation to provide educational grants to Indian college students.

WELFARE

The Bureau's Welfare Program is responsible for a variety of welfare activities, which in non-Indian communities are generally carried on by several agencies. Within the limits of available resources, the

Welfare Program has continued to cope with Indian needs when such assistance is not available from other sources by:

(1) Providing financial assistance to needy Indian families living on reservations.

(2) Providing counsel and guidance to Indians having family problems or other serious social problems with the objective of promoting family stability and enabling Indians to lead independent, self-supporting lives.

(3) Providing child welfare services when such services are not available from established agencies, including arrangements for protection and care for dependent and neglected children, planning for adoption, and securing appropriate institutional care for handicapped and mentally retarded children through State agencies.

(4) Interpreting the social needs of Indian families and children to tribal governing bodies and providing assistance, when necessary and appropriate, in the development of tribal programs to meet these needs.

(5) Providing information and liaison assistance to Indians to enable them to secure needed welfare services and assistance from State and local welfare programs for which they may be eligible.

(6) Providing advice and counsel to Indians, when necessary, planning constructive use of their own and their children's funds.

(7) Interpreting the needs of Indians to community agencies and leaders away from the reservation and promoting the acceptance of Indians by these agencies on an equal basis with non-Indians.

General Assistance

The need for general assistance has increased. This is attributed in a large part to temporarily lower employment and relocation opportunities for Indians. During fiscal 1958, there was an increase from 1957 of slightly over 10 percent in the number of needy Indians who received assistance, and in the amount of assistance funds expended. The number receiving assistance in 1958 ranged in the usual seasonal pattern from 4,405 in August 1957 to 14,566 in March 1958, with an average monthly load of 8,324 persons. The average monthly grant per person was \$22.38. The increase took place chiefly in the Phoenix, Muskogee, and Aberdeen areas. There was a considerable decrease in assistance needs in the Billings area and a slight decrease in the Anadarko area. It was necessary to begin an assistance program on the Cherokee Reservation in North Carolina in March 1958.

It is significant that the overall increase from 1957 in assistance needs came in the latter half of the fiscal year. During the first half of the year there were increases in some areas and decreases in other

h no appreciable overall difference in the amount of funds expended and even a slight decrease in the total number of Indians giving assistance. During the second half of the fiscal year, however, the amount expended for assistance increased by over 16 percent from the amount expended during the second half of the previous year, and the number of Indians receiving assistance increased over 17 percent. Therefore, the monthly rate of expenditure for assistance at the end of 1958 was considerably greater than at the end of 1957.

Child Welfare Services

There has been a noticeable improvement in meeting the needs of dependent or neglected Indian children either in their own homes or in foster homes when placement outside the home is indicated, although considerable unmet need in this field remains. The number of handicapped children for whom appropriate care was secured in specialized institutions also increased slightly. Contracts for foster care of Indian children were continued with the States of Minnesota, North Dakota, and South Dakota.

In addition to reaching a larger number of children through existing Bureau services, different approaches have been undertaken to solve stubborn and difficult child welfare problems. Efforts made by Welfare and Law and Order personnel of the Bureau to work together on problems of neglect, abandonment, and delinquency are reflected in some tribal activities as in the case of ordinances passed during the year by the Navajo Tribe regulating the care, custody, and control of neglect, abandonment, and delinquency.

A major problem on reservations is the lack of recreational opportunities and group activities for Indian youth, a lack which has contributed to juvenile delinquency. As a pilot project, a specialist experienced in working with youthful gangs was assigned to the Winnebago Agency in Nebraska to work with children, parents, and the community in developing opportunities for youth recreation and group activities.

Certain State courts have taken the position that where State law and order does not extend to a reservation, the State has no legal jurisdiction over Indian children living on a reservation. This has been a problem of long standing but has become increasingly serious because some courts which in previous years have taken appropriate action for the protection of Indian children in such matters as adoption, custody and commitment to appropriate institutions, are asserting their lack of jurisdiction. This has hindered or prevented the provision of adequate care for many Indian children who

are abandoned, neglected, handicapped or otherwise in need of commitment to specialized institutions. Tribal courts, even though they may have authority to provide for protection of children on the reservation, are generally not equipped to do so, and are unable, of course, to make commitments to State institutions. In addition, the jurisdiction of the tribal courts is limited to the reservation. The situation constitutes a problem also for the Division of Indian Health of the Public Health Service, and the Bureau is engaged in joint consideration with that agency of ways and means of resolving this jurisdictional problem.

Activities Under Terminal Legislation

In connection with the Klamath Termination Act, welfare workers of the Bureau played a definite part during 1958 in establishing standards for determining which members of the tribe are in need of assistance in conducting their affairs, and for determining from case information and family histories which persons were most suitable to represent the interest of minors in the tribal election when members were given the choice to remain with or withdraw from the tribe. Activities continued from the previous year in establishing the means by which the interests of Klamath minors and adults in need of assistance in conducting their affairs, would be protected upon termination of Federal supervision over the property and affairs of the tribe.

Social Survey

A comprehensive survey of the human resources of the Confederate Colville Tribes was started in October 1957 in response to a request from the Colville Business Council for assistance in assembling basic data needed in carrying out Section 5 of Public Law 772, 84th Congress, 2d Session (70 Stat. 626). This section of the Act, restoring 818,000 acres of land to the tribes, stipulates that within 5 years from the date of enactment, the Business Council of the Confederate Tribes of the Colville Reservation shall submit to the Secretary of the Interior proposed legislation providing for the termination of Federal supervision over the property and affairs of the tribes and their members within a reasonable time after the submission of such proposed legislation.

LAW AND ORDER

In fiscal 1958, no new legislation was enacted by any State under provisions of Public Law 280, 83d Congress, to assume civil and

criminal jurisdiction over Indian land in such State. Legislation enacted by South Dakota in fiscal 1957 did not result in assumption of jurisdiction by the State under the somewhat complex procedures established. Tribes in South Dakota generally have opposed assumption of jurisdiction by the State. Similar legislation adopted by the State of Washington in fiscal 1957, however, resulted in eight additional tribes coming under State jurisdiction during fiscal 1958. The request of a ninth tribal group in Washington was pending on the Governor's desk at the end of the year.

In the field of jurisdiction, several significant developments occurred in fiscal 1958. In January, the Supreme Court of Arizona held that State laws do not apply to Indians on highways within a reservation. Subsequently, the New Mexico Supreme Court handed down a similar ruling. The Arizona Supreme Court also affirmed the ruling of a lower State court that civil process issued by a State court was effective against an Indian on the Navajo Reservation in connection with the levy and sale of nontrust Indian livestock in satisfaction of a debt but reversed the decision on other grounds. Because of the implications of the ruling regarding effectiveness of State court process on Indian lands, counsel for the Navajo Tribe sought and was granted a writ of certiorari to the United States Supreme Court. The Solicitor General of the United States has been invited to file a brief with the Court setting forth the position of the United States on the jurisdictional question presented. The Solicitor for the Department of the Interior has been asked by the Solicitor General for comment on the matter. It is hoped that the review of the case by the United States Supreme Court will clarify some of the complexities now surrounding the question of jurisdiction on Indian lands.

The North Dakota Supreme Court handed down a decision in a case involving the question of whether an Indian resident of a reservation had access to a fund created under State law and known as the Unsatisfied Judgment Fund, the purpose of which is to lend assistance to persons involved in automobile accidents in cases where those responsible are judgment proof. The court ruled that the courts of the State are open to civil actions by all persons regardless of residence within the State.

Only three tribes acted to legalize the introduction and possession of intoxicants within their reservations during the fiscal year 1958. They were the White Mountain Apache of Arizona and the Jicarilla Apache and the Sandia Pueblo of New Mexico.

The decision by an Alaska Federal Court, mentioned in the 1957 annual report, holding that Territorial laws do not apply to Alaska natives, appears to have been overcome by enactment of H. R. 9139



Eskimo craftsmen make fine jade jewelry at Noorvik, Alaska, north of the Arctic Circle.

which amends Public Law 280 removing doubt regarding the application of local laws. The bill was amended prior to its passage, in view of the Alaska statehood law, to provide that State or Territorial law would apply. It is hoped that the passage of the bill will enable the Bureau to withdraw the special law enforcement services rendered in Alaska.

ARTS AND CRAFTS

The Indian Arts and Crafts Board continued its diversified program of promoting the economic welfare of Indians by providing them with guidance and help in the development and promotion of their arts and crafts.

A village workshop program was started in Alaska as a cooperative venture by the Indian Arts and Crafts Board, the Bureau of Indian Affairs, and the Alaska Rural Development Board. The first workshop building has been completed and is in operation. It is located at Shungnak where a jade project was started in 1954. Erecting a building above the Arctic Circle is no small venture, since all material has to be shipped in. Logs were cut, then lumber sawed, milled, and floated down the Kobuk River 30 miles to the building site. When the building was completed, a light and heating plant was installed with equipment for 14 jade cutters. The demand for the work produced at Shungnak has far exceeded the supply. With a suitable building and additional equipment, a more efficient operation will result and prospects are excellent for a highly successful program.

The second village workshop building, also to house a jade project, was under construction at Noorvik at the close of the fiscal year. Prospects were that it would be completed and in operation during the first half of fiscal 1959.

The third workshop will be at Kivalina where the so-called caribou hoof project is in operation. Here distinctive items of jewelry are fashioned from caribou hoofs by Eskimo craftsmen. This project was started about 2 years ago and the jewelry items which are made here have found a ready market. Instead of a log building at Kivalina, a portable shop building with necessary equipment has been purchased; and this also was expected to be set up and in operation in early fiscal 1959.

The Qualla Arts and Crafts Mutual at Cherokee, North Carolina, experienced another successful year. Preliminary plans have been made for the erection of a building which will house all the activities of this organization. This will not only mean a better location for the retail shop, but will also allow for expansion of the program.

An arts and crafts specialist has been assigned to Florida to work with the Seminoles. A small but successful crafts guild has been in operation on the Brighton Reservation, and during the past year this guild has hired as its manager a Seminole girl who is a recent graduate of Haskell Institute. In addition to giving assistance to the guild, the arts and crafts specialist works directly with the craftsmen at the Dania and Big Cypress Reservations and with the Indians who live on the Tamiami Trail. Assistance is provided in the field of production and marketing, with particular emphasis on maintaining high standards of workmanship.

The Southern Plains Exhibit and Craft Center at Anadarko, Oklahoma, has been completely redecorated and renovated. New exhibit cases and exhibits have been added; the old cases have been painted and rearranged. The Oklahoma Indian Arts and Crafts Cooperative, which is located here, has continued to make progress, in spite of the fact that the group has had limited capital with which to operate.

Redecorating and renovating has also been done at the Sioux Indians Exhibit and Craft Center in Rapid City, S. Dak. The director has continued to give assistance to craft groups in the area, particularly at Rosebud, S. Dak.; Tama, Iowa; and Pipestone, Minn. These groups have all had a successful year.

The Indian Arts and Crafts Board has continued its exhibit program by making available on a loan basis its excellent collection of contemporary Indian arts and crafts. This has helped to acquaint the public with the wide variety, usefulness, and fine workmanship of Indian arts and crafts.

TRIBAL PROGRAMS

Klamath

Disposition was completed in fiscal 1958 of all appeals to the Secretary of the Interior contesting the inclusion or omission of the name of any person on or from the proposed final roll of Klamath tribal members as published in the Federal Register of May 13, 1957. Notice of the final roll of the tribal membership was approved October 10, 1957, by the Assistant Secretary of the Interior and published in the Federal Register on November 27, 1957.

In August 1957, the Portland Area Office of the Bureau began procedures to determine which members of the Klamath tribal group will need assistance in managing their affairs after termination of Federal trusteeship. Of the 2,113 members on the final roll, 183 individuals were judged to be in need of such assistance. Five persons appealed these findings.

In September 1957, the management specialists transmitted to the tribe the tentative management plan for the residual tribal estate and gave the tribal members until January 10, 1958, to submit suggested modifications.

One of the two remaining management specialists resigned December 31, 1957, because of ill health. A new man was selected to fill the vacancy and entered on duty April 1, 1958.

On February 20, 1958, the Secretary of the Interior accepted the Klamath Appraisal Report and tentative management plan. The appraisal set the "realization value" of Klamath tribal assets at \$1,659,618. In compliance with the act of August 13, 1954 (68 Stat. 718), the management specialists on March 7, 1958 mailed to each Klamath member an election form giving him or her the opportunity either to withdraw or remain with a tribal entity continuing under State law. The final tabulation showed that 1,659 or 77.778 percent elected to withdraw and 474 or 22.222 percent decided to remain.

The basic contract with the management specialists was scheduled to terminate on March 31, 1958. However, because of the act of August 14, 1957 (71 Stat. 347) which amended the original Klamath Act and postponed the termination, it became necessary to extend the contract to August 12, 1960.

To carry out the responsibility for protecting the interests of minors, non compos mentis individuals, and those determined to be in need of assistance, individual trusts were established with banking institutions for about 900 tribal members.

On June 30, 1958, the management specialists partitioned all lands and other tribal property between the withdrawing and the remaining members. Property belonging to the withdrawing members will be converted into cash for distribution among them.

Menominee

The act of June 17, 1954 (68 Stat. 250), which provided for termination of Federal supervision over the affairs of the Menominee Tribe, stated that at midnight on the date of enactment, the roll of the tribe maintained pursuant to the act of June 15, 1934 (48 Stat. 965), as amended, was closed, and no children of members born thereafter were entitled to enrollment. A proclamation of the final closure of the membership roll, with the listing of all enrolled members, was published in the Federal Register on December 12, 1957.

The Congress considered various proposals during 1957-58 to amend the Menominee termination act. At the very close of the fiscal year, an agreement was reached to extend the period for tribal planning to

February 1, 1959 (from December 31, 1957); and to defer the requirement of complete termination of trusteeship until December 1960, an extension of 2 years. The Secretary of the Interior is not required to complete the termination process in the event that the Menominee Tribe defaults in proposing its own plan for the future. The amendment also modified the statute by establishing a form which provides for complete Federal reimbursement of the tribe for approved termination expenses incurred up to July 2, 1958, for percent reimbursement and for such expenses thereafter up to combined maximum of \$275,000.

During the year, the transitional program was chiefly concerned with the preparation of surveys by the Menominee Indian Study Committee of the State of Wisconsin, the creation of a tribal Coordinating and Negotiating Committee to incorporate the studies in a plan for the future unrestricted management of tribal affairs, and the retention of a firm of tax consultants to advise on the most advantageous form of future business and governmental organization. The special Menominee adult education program was intensified by synthesizing these studies into concise and simple form for widespread circulation among the tribal membership.

Uintah and Ouray

Division of tribal assets between the full-blood and mixed-blood groups on the Uintah and Ouray reservation in Utah in accordance with the act of August 27, 1954 (68 Stat. 868), was completed in fiscal 1958. Termination of Federal trusteeship affecting the mixed blood group is scheduled to take effect by 1961.

Cheyenne River

In April 1958, a committee representing various offices of the Bureau of Indian Affairs was formed to study additional rehabilitation needs at the Cheyenne River Sioux Reservation in South Dakota. Projected cumulative requirements for the rehabilitation program, was found, will reach a peak of \$6,895,000 in 1963, after which repayments on loans are expected to exceed requirements for new funds.

The rehabilitation and relocation fund, appropriated by Congress under Section V of the act of September 3, 1954 (68 Stat. 1191), as an additional award following land takings for the Oahe Dam, totaled \$5,160,000. The Committee estimated that rehabilitation of resident tribal members will require approximately \$1,735,000 more before funds accruing from repayments will be sufficient for the program to be self-supporting.

Dalles Dam Settlement Fund

The Yakima Tribe of Washington and the Umatilla Tribe of Oregon adopted programs for the use of their shares of the Dalles Dam settlement fund. The Warm Springs Tribe of Oregon established a trust for their minor members. The Umatilla began formulation of a similar trust.

Seminole Tribe of Florida

For the first time in their history, the Seminole Indians of Florida, working with Bureau officers, developed a constitution and bylaws and a corporate charter and bylaws. These were accepted by the tribe on August 21, 1957, by a vote of 223 to 5 at an election held pursuant to Secretarial authorization. On September 19, 1957, the tribe, in accordance with the two documents, elected a tribal council and a board of directors.

During the first year of operation, the new tribal organization established a \$200,000 credit program, completed a 7,500-acre improvement project at Big Cypress reservation, took steps to stabilize and to improve the tribe's 6,000-head herd of cattle at Big Cypress and Brighton, and initiated plans to develop commercially a valuable tract of land at Loxley, 25 miles north of Miami.

Red Lake Chippewas

Following the death in 1957 of an outstanding Indian, who for many years had led the Red Lake Band of Chippewa in Minnesota through the strength of his personality, bitter factionalism developed within the band. On March 19, 1958, it became necessary for the Secretary to suspend the band's tribal government because of an impasse developed by the existence of two councils, each claiming to be the band's legally constituted governing body.

Meanwhile, a committee of Department of the Interior officers outside the Indian Bureau had been investigating the Red Lake situation. As a result of the report to the Secretary by this committee, the Bureau issued regulations for an election on May 22, 1958, by which the band chose a seven-member constitutional committee to draft a constitution for the future conduct of tribal business, replacing the old codified constitution of 1918. With the help of the Bureau, this Committee worked out a new constitution and bylaws which were submitted to the Secretary for his approval.

NAVAJO-HOPI REHABILITATION

In the Navajo and Hopi areas, work moved forward on a wide variety of beneficial projects launched under the authorizations provided in the 1950 legislation (Public Law 474, 81st Congress). Especially noteworthy progress was made in the construction and expansion of schools, the improvement of existing roads and irrigation projects, and the further broadening of soil and moisture conservation operations.

While no new school construction jobs were launched with Public Law 474 funds in fiscal 1958, 10 projects initiated earlier were completed during the year and 8 others were moved forward to the point where completion was expected early in 1958-59 school year. The completed projects, providing space for 370 additional students, were at Mariano Lake, Pinedale, and Aztec in New Mexico; at Smoke Signal, Blue Gap, Low Mountain, Tachee, White Cone, and Snowflake in Arizona; and at Richfield, Utah. Projects nearing completion included the construction of a dormitory at Flagstaff, Ariz., which will make it possible for 300 Indian children to attend the local public schools, and the expansion of existing Federal facilities on the reservation at Beclabito, N. Mex., which will provide for 32 additional children. In addition, conversions or expansions at Huerfano and Borrego Pass in New Mexico and at Holbrook, Seba Delkai, Lukachukai, and Round Rock in Arizona are scheduled to provide space for 625 additional students during the fall of 1958.

Aside from the Federal school construction projects, four public school facilities were under construction during the year at Tohatchi, Tse Bonita, and Church Rock in New Mexico and at Fort Defiance, Ariz. They will provide space for about 365 children.

Public Law 474 funds in the amount of \$106,080 were allocated in fiscal 1958 to develop water supplies for reservation schools. With this allocation plus \$47,298 of carryover funds, wells were drilled at 6 school locations on the New Mexico portion of the Navajo Reservation (Jones Ranch, Brad Springs, Mariano Lake, White Horse Lake, Pueblo Pintado, and Crownpoint) and at 8 localities in Arizona (Pin Springs, Whippoorwill, Rock Point, Leupp, Kaibeto, Salina, Cottonwood, and Lukachukai).

For road construction \$2,732,180 was allocated in fiscal 1958 to make a total of \$13,870,180 appropriated to date under this heading. Public Law 474 authorized appropriations totaling \$20,000,000 for road construction over the 10-year life of the program. One of the major projects carried out in fiscal 1958 was the grading and draining of a 16-mile stretch of road running east from Window Rock, Ariz.

a junction with U. S. Highway 666 in New Mexico which will be surfaced and maintained by the State of New Mexico in accordance with an agreement with the Bureau of Indian Affairs. On the main uns-reservation road known as Route 3 (running from Window Rock on the east to Tuba City, Ariz., on the west) paving work was completed between Ganado and Lizard Springs, leaving only a 28-mile stretch between Dinnebito Wash and Coal Mine Mesa that still remains unpaved. In addition, paving work was completed on a 10-mile section of road branching north of Route 3 from Lizard Springs to Chinle and a contract was awarded for paving the road that runs still further north from Chinle to Many Farms. Other contracts awarded during the fiscal year will provide for (1) construction of Route 18 from Kayenta, Ariz., to the Utah State line linking up this important northern center on the reservation with State and Federal highways in Utah and Colorado, and (2) for construction of a bridge across the San Juan River near the point where it is joined by the Antezuma Wash. This latter project is particularly important in connection with the oil and gas development in the Four Corners area of the reservation and is being financed partly by Federal appropriations and partly by contributions from the interested oil companies. For irrigation construction, \$455,500 of Public Law 474 funds was programmed in fiscal 1958 bringing total appropriations in this category up to \$4,337,775 as measured against the original authorization of \$9,000,000. The major portion of the 1958 money was used on the Gback project—\$348,237 for constructing 2.7 miles of main canal and a siphon of 1,188 feet in length and 72 inches in diameter across Canyon, and \$26,282 on the Helium Unit of the project for releveling 90 acres, rebuilding 1 lateral, and resetting 10 irrigation structures to grade. In addition, \$20,481 was spent on the Fruitland project for replacing old timber check drops and an additional \$20,000 was used to investigate the feasibility of irrigation construction in numerous localities throughout the reservation.

Under the heading of soil and moisture conservation and range improvement work, Public Law 474 authorized appropriations totaling \$10,000,000. In fiscal 1958 the appropriation for this purpose was \$675,655 bringing the cumulative total up to \$4,646,625. Of this amount, \$1,042,560 was used over the 8-year period for the drilling of groundwater wells over the reservation area and this was supplemented by \$1,932,835 of Indian Bureau funds from regular appropriations and by \$1,844,000 of Navajo tribal funds. Under this program 307 wells were completed by the end of fiscal 1958—155 with Navajo tribal funds and 152 with funds supplied by the Bureau of Indian Affairs. Other phases of the soil and moisture conservation program

have included the construction of dikes, jetties, diversion ditches, spreaders, and charcos; the eradication of juniper and sagebrush and the leveling and reseeding of range areas.

For surveying the resource potential of the area, the Rehabilitation Act authorized \$500,000 of appropriations. Under this authorization \$17,510 was made available in fiscal 1958 and was used for geological mapping carried on by the Branch of Fuels of the United States Geological Survey. The study takes on special importance because of the rapidly growing oil and gas development on the Navajo Reservation.

RELOCATION SERVICES

For the first time since the start of the program of Relocation Services in 1952, the number of Indians assisted in relocation showed a drop in 1958 as compared with the previous year. Assistance was provided this past year to 5,728 men, women, and children or approximately 18 percent less than the 6,964 assisted in fiscal 1957.

The reduction was attributable chiefly to the economic conditions which were felt in the relocation destination cities in the early part of the fiscal year. By November 1957, previously relocated Indian workers were reporting lay-offs and were requesting Bureau assistance in securing new employment. For several ensuing months the scheduling of new relocatees was reduced and carefully controlled so as to concentrate greater effort on reemployment activities for the benefit of those already relocated. In the main, these efforts were successful and many experienced only relatively short periods of unemployment. A limited number, however, were unable to adjust to the necessity of accepting lower-paying jobs temporarily and decided to return to the reservations.

In April 1958 slight improvements were noted in the employment situation of the destination cities and by the latter part of May conditions improved to the point where normal relocation scheduling was resumed.

There was an increase in the backlog of applications from Indian workers and their families waiting for relocation assistance. In early May, this backlog reached a high point of 938 applications covering 3,167 persons. With the resumption of full scheduling in June, however, the backlog was reduced to 764 applications representing 1,902 people.

During the year the Bureau maintained field relocation offices in 12 destination cities: Chicago, Joliet, and Waukegan, Ill.; Denver, Colo.; Los Angeles, Oakland, San Jose, and San Francisco, Calif.; Cincinnati and Cleveland, Ohio; Dallas, Tex.; and St. Louis, Mo.

At the close of the period, however, the operations in Joliet and Duquagan were discontinued because of the comparatively limited employment opportunities available in these smaller cities and the operational responsibilities were transferred to the Chicago office.

Of the 5,728 persons who received relocation assistance during the year, 4,331 were included in 976 family units, 1,023 were unattached men, and 374 were unattached women.

INDUSTRIAL DEVELOPMENT

The Bureau's Industrial Development Program, which was initiated early in fiscal 1956 as a function of the Commissioner's office to encourage the establishment of small plants on or near reservations and the employment of available Indians, was expanded in September 1957 by the establishment of the Branch of Industrial Development in the Division of Economic Development.

Once the Branch was established, a study was made to determine the type of organization that would be most effective in stimulating the development of job opportunities for Indian people in Indian country. It was felt that a solution could best be arrived at by approaching the problem on a community basis, with the full cooperation and participation of tribal leaders, leaders of nearby non-Indian communities, and State and local industrial organizations.

There are three distinct phases of the Indian Industrial Development Program:

- (a) Planning on the local and area levels with tribal, community, State, and industrial leaders and officials in the development of information and brochures concerning resources and facilities available and industrial prospects;
- (b) Development of industrial prospects through personal contacts with industrialists, representatives of trade associations, the National Association of Manufacturers, and other organizations;
- (c) Negotiation of on-the-job training agreements with cooperating industries (having an acceptable training program leading to skilled or semi-skilled work for Indians on a full-time basis) under which the industry will be reimbursed for training services at an agreed upon rate.

Organizationally, to fulfill the functions of the Branch, besides a small Central Office staff, industrial specialists have been appointed to the various area offices of the Bureau to develop necessary information and work with expanding industries in the areas. Industrial development specialists headquartered in field offices located in several large industrial centers develop industrial prospects, through all available avenues of approach, with firms indicating an interest in

expanding their operations. The story of resources and facilities available to industry in Indian communities, as developed locally, carried to the industrial prospects, who then are referred to the area of interest.

An example of the type of industrial enterprise established through joint efforts of the tribe, local community and the Bureau is a furniture factory located at Kingman, Ariz., near the Navajo Reservation. The county provided the building facilities at reasonable cost; the community organization cooperated in housing and cultural facilities for the Indian workers; the Navajo Tribe and the Bureau assisted with financing of the training program and by giving counseling and guidance to the workers.

During the past fiscal year on-the-job training agreements were negotiated, under Public Law 959, 84th Congress, with 13 cooperating industries for the employment and training of Indians in the manufacture of garments, house trailers, toys, electrical instruments, wood work, leather goods, upholstering, archery supplies, veneer and plywood production, and souvenirs. The plants providing the training are in Arizona, North Carolina, New Mexico, Oklahoma, South Dakota, Washington, and Wisconsin. Under these agreements training was provided for a total of 168 Indian workers. Ten of the agreements were in effect at the close of the fiscal year.

ADULT VOCATIONAL TRAINING

In addition to the training provided in plants near the reservations as noted above, steps were also taken in fiscal 1958 to activate a program under Public Law 959 for the enrollment of Indian trainees in regularly accredited vocational schools. Such training was provided in all 10 of the Bureau's administrative areas and in 8 of the cities where relocation field offices are located: Chicago, Cincinnati, Cleveland, Dallas, Denver, Los Angeles, Oakland, and St. Louis. Applications for the training were taken at field agencies and similar Bureau offices.

During the year approval was given to 165 various occupational courses in 65 different trade or vocational schools and 376 adult Indians were enrolled in these courses. Because most of the courses are of a long-range nature, only four Indians actually completed their training during the year; 37 others discontinued the training for various reasons. At the close of the period 325 applications were on file and awaiting action.

The Bureau has staffed each of the offices where training is available with qualified training officers who are assisting the applicants with the necessary counseling relative to the appropriate training.

ective they should pursue. Grants of financial assistance covering tion and related costs, and other necessary items, are being furnished to the participants in the program as their needs require. Interest in the program is indicated by the number of Indians already participating and the inquiries that have been made about it and promise of greatly broadened participation in the future.

REALTY

Acquisition and Disposal

Important developments under this heading in fiscal 1958 included:
1) A clarification of procedures to insure (a) that all tribes have an opportunity to consider the purchase of lands offered for sale by

In 1958 the Indian Bureau's new adult vocational training program gave hundreds of young Indians a chance to develop job skills and improve their earning prospects.



their members and (b) that all Indians requesting sale of their lands or for whom Federal restrictions are terminated, are fully advised regarding the mineral potential of their lands, with mandatory safeguards imposed for those who need assistance in managing their affairs.

(2) Revocation of the so-called "all-or-none" policy which requires that individual Indians applying for a fee patent on a portion of their lands must take a fee patent on all of their trust or restricted lands.

(3) The enactment by the Congress of legislation favored by the Department which restored 70,199.3 acres of ceded lands to tribal ownership on five reservations.

(4) Preparation of regulations and instructions for the allotment of lands on the Torres-Martinez Reservation in California.

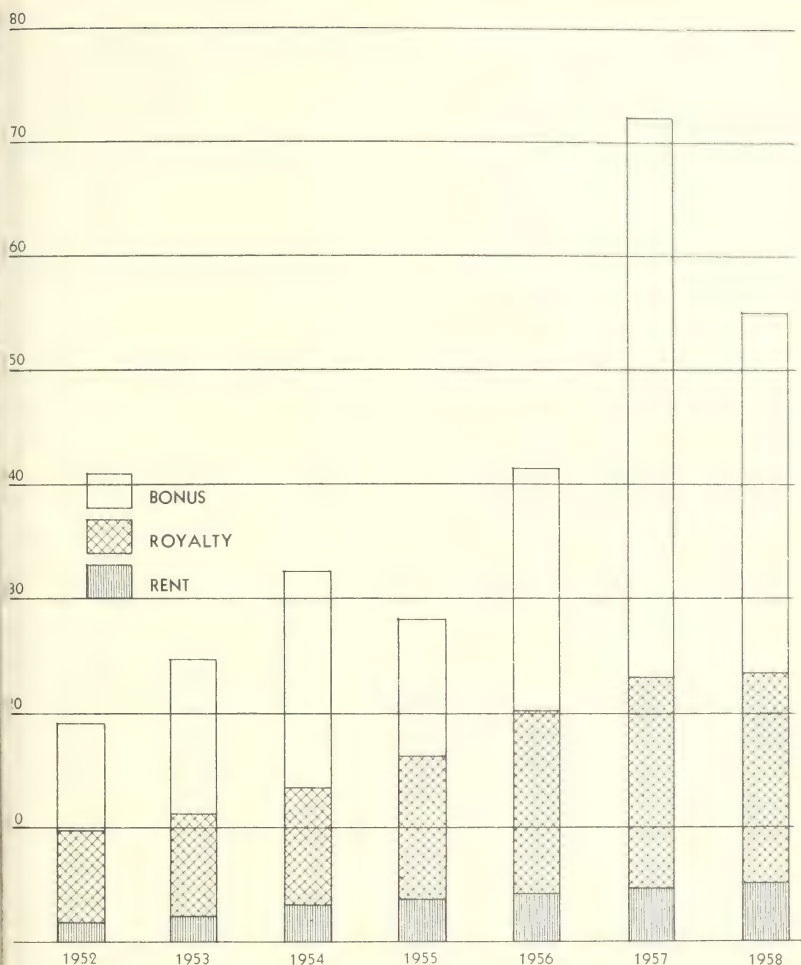
(5) The establishment of a workable plan for the equalization of allotments on the Palm Springs Reservation in the same State.

During the year, the Bureau processed a total of 11,290 real estate transactions involving acquisition and disposal of Indian trust properties. Altogether 335,895.8 acres of trust or restricted land was removed from Federal trusteeship or supervision in response to applications or requests from the Indian owners. Sales made at the request of the owners accounted for 6,930 of these transactions; issuance of fee patents to Indian applicants, removals of restrictions and certificates of competency requested by Indians for 1,593 transactions; partitions for 450; and exchanges for 2,317. In addition, 1,000 other transactions were completed during the year which had no material effect on the over-all acreage of land in trust or restricted status.

Minerals

In the 1958 fiscal year, 3,239 new oil and gas leases on Indian lands were approved and the net total of such leases in force at the close of the period was 19,204. These leases covered 5,296,373.9 acres and provided a total income to Indian landowners in fiscal 1958 of \$55,210,467. Of this amount \$31,403,437 represented receipts from bonus bids. The acreage in new leases for oil and gas development leveled off to a considerable extent during the year, chiefly because of the pickup in exploration of large areas of wildcat acreage previously under lease.

As was generally predicted, the Four Corners area (which includes parts of the Navajo, Ute Mountain, and Southern Ute Reservations) retained the lead as the top exploratory field in the country. This includes the Aneth area in Utah, which is the most significant new



INCOME FROM OIL AND GAS OPERATIONS ON INDIAN LANDS FOR FISCAL YEARS 1952-58

A total of 5,296,374 acres were under oil and gas lease at end of fiscal year 1958,
covered by 19,204 individual lease contracts

in the Rocky Mountain Region since the discovery of oil in the
W. At one advertised lease sale alone, slightly in ex-
of \$28,000,000 was bid for Navajo oil and gas leases. This is
more than the bonus bids received for leases on all of the other Indian
reservations. Drilling activity at Navajo has increased sharply from
3 wells drilled in fiscal 1956 to 118 in 1957 and 210 in 1958. The
number of producing wells has increased meanwhile from 109 at the
end of the 1956 fiscal year to a current figure of 366. The completion

of two oil pipelines during the year from the Four Corners area, Jal, N. Mex., and Los Angeles should greatly increase the market for the crude oil.

The optimistic predictions on waterflooding of the oil leases in North Burbank and other fields of the Osage Reservation in Oklahoma have been confirmed by steadily increased production. Waterflooding in the North Burbank field started on a progressive basis with the injection of water in 1950. To assist in the project, the Osage Tribe agreed to reduce the royalty from $\frac{1}{6}$ to $\frac{1}{8}$ on the oil produced from waterflooding. This action proved farsighted.

In the mineral field other than oil and gas, a significant development was the approval of an iron ore lease on 557 acres of the Chilkoot Indian Village in southeastern Alaska, and a coal lease covering slightly in excess of 24,000 acres of Navajo tribal land in New Mexico. It is planned that the coal will be used for power development. A uranium lease sale held in September of 1957, leases on 218 Navajo allotted tracts brought a bonus of \$514,199. Since then, the demand for uranium leases has declined and applications for shutdown permits have been submitted. The main factor in the decline is the limited facilities for milling ore. It is felt that the decline is only temporary. Income for the Indian owners from the Jackpile uranium mine on the Laguna Pueblo, N. Mex., during the year amounted to \$1,732,171. The depressed market conditions have resulted in curtailment of operations in the marginal lead and zinc fields of the Quapaw Reservation, Okla. The total Indian income in fiscal 1958 from minerals other than oil and gas amounted to \$4,407,888.

The 10-year primary term expired during the year on most of the phosphate leases on the Fort Hall Reservation in Idaho. Some of the leases were terminated because of lack of production. In other cases new leases were entered into by the Indians with the original lessors, and operations under some leases were unitized. While on a large operation, the leases have returned a steady income to the Indians over the past 10 years.

Tenure and Management

In fiscal 1958 the Bureau processed 869 cases granting rights-of-way over Indian lands for various purposes. Present statutory authority vests the power to grant rights-of-way over or across Indian lands in the Secretary of the Interior. With some exceptions, specifically mentioned by statute, the grant of a right-of-way may be made only with the approval of the Indian owners. The authority of the Secretary to grant rights-of-way, when such grants are in accordance with the prescribed regulations, has been delegated to the operating field level.

At the close of the year there were 31,740 surface leases or permits of all kinds in force on Indian lands, covering 3,873,263.2 acres and providing an annual rental of \$8,430,264 for the Indian owners. These leases and permits cover the use of Indian lands for farm, range-pasture, grazing, and business purposes. They do not include lands incorporated in range units. The authority for long term leases provided in the act of August 9, 1955,* is slowly being recognized by the Indians and their lessees. More business and land development leases were made during fiscal 1958 that provide for substantial capital investment by the lessees. Leases of this type were generally not practical under the shorter tenure requirements of previous legislation. On the Papago Reservation in Arizona, for example, 12,500 acres of desert lands are being subjugated and developed for irrigation farming under such a lease.

The continuing population growth in the United States and the related demand for new agricultural areas for development in the West sustain a fairly uniform demand for the leasing of Indian agricultural lands, and a great many individual Indian people for whom the Federal Government holds lands in trusteeship have derived substantial incomes, as do their non-Indian neighbors, from rentals of their lands.

Certain conditions, unique to the title patterns with which Indian allotments are encumbered, contribute largely to the high percentage of allotted Indian farmland used by non-Indians under leases. Because the United States has been required to hold title in trust for succeeding generations of heirs of original Indian allottees, a large percentage, considerably more than half, of the allotments are now held in multiple ownership. In extreme cases, the number of heirs owning fractional portions of an allotment may run as high as several hundred.

With the prohibition against further allotment of tribal lands contained in the Indian Reorganization Act of 1934, there arose a need to make provision for homesites for landless members of the tribes. Also, many unallotted Indians had inherited interests in many allotments without holding a controlling interest in any single tract. To meet these problems, the formal assignment program was developed by which Indians could surrender their undivided interest in allings to the tribe and receive in return the life-use right to a tract of tribal land. On those reservations where allotments had not been made, a system of assigning use rights on certain lands to heads of families had long existed. Most of the tribal constitutions contain provisions for granting such rights. Generally, such assignments may be devised or inherited, or a provision is made whereby the assignor may designate a successor providing that the devisee, heir, or

designated successor is a member of the tribe. A serious problem of valuation is encountered when relinquishment or liquidation of assignment is necessary. Recently, the Navajo Tribe resolved the problem by enacting a resolution to grant homesites by means of long-term leases.

Records

The present system of one centralized land recordation at the Washington office is not considered satisfactory, principally because of the fact that the majority of land transactions may be approved in the field either at the Agency or area offices.

The approval authority is with the operating offices, whereas legal descriptions and source documents are contained in the records of the central office. To correct this situation, the Bureau's Branch of Realty, with departmental approval, is now undertaking the revision and decentralization of the basic land records of the Bureau.

Much preliminary exploratory work remains to be done, however, before the present land records system can be converted to the new Title Index Control which is proposed as a uniform system for the entire Bureau. This conversion will be based on the Torrens recordation system, with modifications as required to meet special needs. The plan is to install the new system in a few test areas during the early months of fiscal 1959 in order to prove its practicality and applicability to Indian land recordation.

FOREST MANAGEMENT

Timber Sales

In the fiscal year 1958, the volume of timber cut under contract at the Klamath Reservation in Oregon was 27 million board feet, compared with more than 122 million board feet in the calendar year 1956. Cash receipts from these sales were \$1,104,000 in fiscal year 1958, compared with \$4,250,000 in the calendar year 1956. The reduction in timber sales at Klamath was a part of the preparation for terminating Federal trusteeship over the tribal estate under the provisions of Public Law 587, 83d Congress, as amended.

There was also a substantial reduction in timber sales at most of the other reservations, caused by lessened demand for forest products. At these reservations, the volume of timber cut under contract fell from 507½ million board feet in calendar year 1956 to 433½ million board feet in 1957. Cash receipts dropped to a lesser extent, from \$9 million in 1956 to \$8½ million in 1957.

The timber sold in calendar year 1957, exclusive of the Klamath Reservation, was distributed among reservations under several area office jurisdictions as follows:

| Area | Volume— thousand feet board measure | Receipts |
|---------------|---|-----------|
| ings..... | 19,600 | \$381,000 |
| up..... | 34,500 | 409,000 |
| neapolis..... | 47,200 | 836,000 |
| kogee..... | 1,100 | 28,000 |
| enix..... | 46,000 | 612,000 |
| land..... | 248,500 | 5,590,000 |
| amento..... | 36,400 | 585,000 |
| | 433,300 | 8,501,000 |

Although the 1-year decline in timber sales was substantial, the sales were still at a relatively high all-time level and cash receipts were the third highest in the entire history of Indian timber sales.

Financing Forest Management

There are two sources of funds to finance the management of Indian forests. Public funds are appropriated by the Congress for this purpose, and some Indian tribes authorize the use of their funds to pay all or a part of the cost of managing their forest property. These expenditures are partially offset by deductions from timber sale receipts to cover administrative costs pursuant to 25 CFR 25. At reservations where there is a substantial timber sale income the expenditures may be for management by the Government or the tribe or both may be fully recovered through the timber sale deductions. Where there is little or no timber sale income, the expenditures (primarily for forest and range protection against fire) are not completely reimbursed.

The accompanying chart shows the 5-year trend in forest management costs and timber sale deductions. Data for Klamath Reservation are not included.

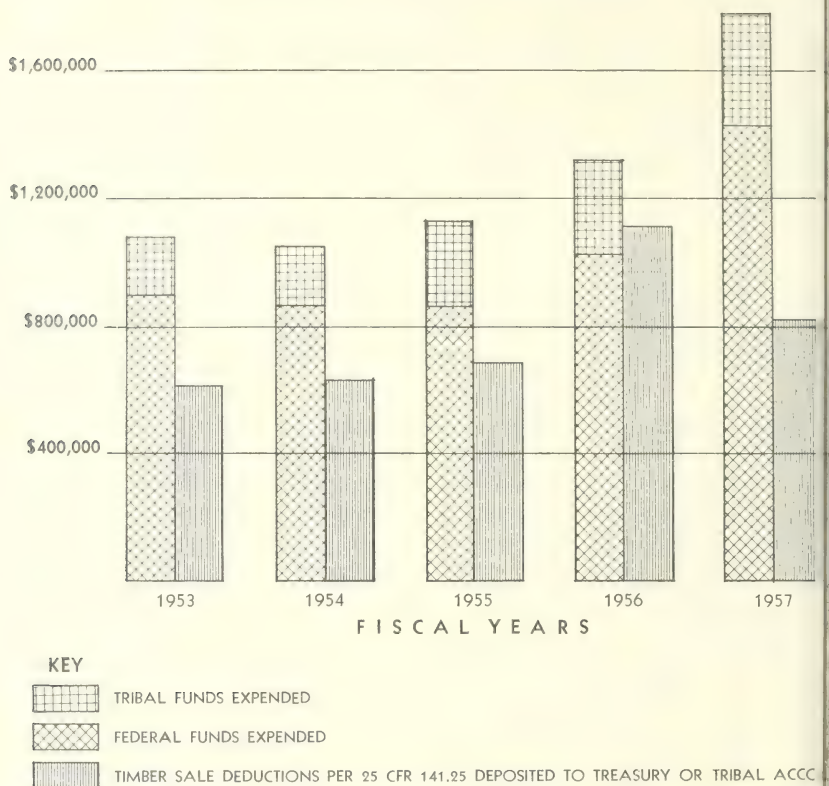
The cost per man-year devoted to forest management has increased from \$5,239 in 1953 to \$6,647 in 1957. This increase has resulted not only from the general rise in material costs and wage rates over the 4-year period but also from increased expenditures, under contract, for aerial photography and timber inventories to be used in calculating the allowable annual cut.

Timber Inventories

During fiscal 1958, continuing progress was made in obtaining timber inventories for the various forested reservations, and in the

FEDERAL AND TRIBAL EXPENDITURES FOR FOREST MANAGEMENT AND TIMBER SALE DEDUCTIONS EARNED FOR DEPOSIT IN FEDERAL OR TRIBAL ACCOUNTS

(DATA FOR KLAMATH RESERVATION NOT INCLUDED)



preparation of forest management plans from which timber schedules are developed. As late as 1952, timber sale planning practically all reservations was based upon old and unreliable data regarding timber volumes, growth potential, and allowable annual cut.

Today, acceptable information is available, or is being obtained for two-thirds of the 6 million acres of commercially important Indian forests. Reliable data are now available for most of the commercially important Indian forests in the Gallup, Phoenix, Sacramento areas, and are either available or being obtained for most reservations in the Portland area. The Northern Cheyenne Reservation, in Montana, has been covered adequately.

Acceptable information for other commercially important Indian forests of the Billings area is not available. Similarly, the Menominee

Indian Reservation is the only one in the Minneapolis area that has been adequately covered, although some data are available for the Red Lake Reservation forest lands.

IRRIGATION

Crops with a total value of approximately \$57,167,000 were produced on 570,264 acres of Indian irrigation project lands in calendar year 1957. The construction and rehabilitation program in the same period resulted in the following major accomplishments:

| | Provided with supplemental water | New | Rehabilitated or replaced |
|---|----------------------------------|-------|---------------------------|
| Construction item: | | | |
| Project land acres..... | 4,300 | 1,400 | 660 |
| Structures..... | | 61 | 516 |
| Wells and pumping plants..... | | 19 | 8 |
| Drains (miles)..... | | 11 | 109 |
| Drinking canals and laterals (miles)..... | | 21 | |
| Water item: | | | |
| Customers..... | | 100 | |
| Transformers..... | | 40 | 25 |
| Transmission lines (miles)..... | | 8.8 | 37 |
| Distribution lines (miles)..... | | | 14 |
| Substations..... | | 1 | 5 |

The San Carlos project (Arizona) in calendar year 1958 is experiencing its best water year since 1949. Storage in the Coolidge reservoir amounted to over 228,000 acre-feet which is greatly reducing pumping requirements, purchase of power and the high costs incidental thereto for the 1958 season.

Following a considerable period of negotiation with the water users of the Blackfeet project (Montana), the method of assessment has been changed from one based on application by the water users to one of general assessment. This change went into effect on April 12, 1958, and is serving to improve very materially the project's ability to provide and maintain better service to the water users.

On the six Middle Rio Grande Pueblos work is accelerating somewhat on the major rehabilitation and land subjugation program authorized under the Flood Control Act of 1948. Early progress has been slow but interest in the program and the tempo of achievement are improving and should increase markedly during the coming year. For the ensuing years, particular emphasis is being placed on continuation of present plans and the start of new plans, surveys and studies necessary for the rehabilitation of some projects and the completion of others with the ultimate aim of preparing them for management by the water users as these groups become sufficiently experienced and are legally authorized to assume such responsibility.



Over \$57,000,000 worth of crops were produced on Indian irrigation projects in 1957.

sibility. Emphasis is also being given to studies and development programs designed to protect Indian water rights and encourage utilization of irrigable Indian lands. A comprehensive construction program is now under way. It is fully in accord with the over-all program of maximum development and use of land and water for the benefit of the Indian landowners.

RANGE, WILDLIFE, AND RECREATIONAL RESOURCES

The Indian range is divided into range units and administered in accordance with the latest principles of good grassland management. Permits authorizing use of the range prescribe maximum stocking, proper season of grazing and other conservation practices to obtain maximum and continued productivity of the forage. Indians are encouraged to make full use of the range lands for the grazing of their own livestock. Range temporarily not needed for their own use is permitted to non-Indians under a system of competitive bids.

Proper management of the tribally owned range still continues to be difficult to achieve in the arid Southwest. Good progress is being made, however, on the Papago, San Carlos, Fort Apache, and Hualapai Reservations of Arizona with the cooperation of the Tribal Councils. The Indians, as a whole, are becoming more aware of the importance of range conservation in their economic life.

TABLE 1.—*Use of range in units, 1957*

| | Acres | Percent | Cattle units | Percent | Use value |
|-------------------|------------|---------|--------------|---------|-------------|
| Total range.. | 41,352,000 | 100 | 829,000 | 100 | \$5,265,000 |
| Total use.. | 40,566,000 | 98 | 820,000 | 100 | 5,265,000 |
| Indian use.... | 6,865,000 | 17 | 339,000 | 30 | 1,606,000 |
| Non-Indian use... | 33,701,000 | 83 | 482,000 | 70 | 3,659,000 |
| Unused.. | 786,000 | 2 | 8,000 | | |

Does not cover farm-pasture lands included in this table of the 1957 Annual Report. Farm-pasture lands reported under Realty Operations of this report.

As more technical information becomes available in the future through studies and surveys, range management plans will be refined to obtain better and fuller use of the range resources.

Obligations for range management and range water development for fiscal 1958 amounted to \$1,217,411.

Fish, wildlife, and recreation are becoming increasingly important on a number of Indian reservations. There is a growing demand by the public for recreational opportunities. The Indians are being encouraged by continued guidance to develop these resources for their economic betterment.

TABLE 2.—*Fish and wildlife—Approximate income or value of 1957 harvest*

| | |
|---|-------------|
| Total all reservations..... | \$3,246,000 |
| Commercial fish..... | 327,000 |
| Domestic fish..... | 653,000 |
| Game Bearing animals..... | 135,000 |
| Game Birds..... | 345,000 |
| Big Game..... | 1,672,000 |
| Receipt from permits (fishing and hunting)..... | 114,000 |

SOIL CONSERVATION

With a total expenditure of approximately \$4,442,000 in Indian Bureau funds and contributions from the cooperating land users amounting to more than \$20,000,000, results were accomplished as indicated in the following tabulation:

Land use investigations and planning

| | Unit | Accomplish-ments | BIA esti-mated cost | Cooper-estima cost |
|-----------------------|-------------|------------------|---------------------|--------------------|
| Educational meetings. | Number held | 3,713 | \$126,108 | \$41 |
| | Attended | 86,020 | | |
| Land use plans | Number | 10,258 | 265,556 | 33 |
| | Acres | 4,548,965 | | |
| Soil surveys | do | 1,595,121 | 331,853 | 3 |
| Range surveys | do | 11,697,484 | 198,930 | 17 |
| Others | | | 347,390 | 15 |

Application of measures

SOIL STABILIZATION AND IMPROVEMENT

| | Unit | Accomplish-ments | BIA esti-mated cost | Cooper-estima cost |
|---------------------|-------|------------------|---------------------|--------------------|
| Brush control | Acres | 160,522 | \$358,598 | \$79 |
| | do | 255,114 | 85,879 | 1,24 |
| Cover crop | Tons | 149,974 | 70,909 | 3,27 |
| Fertilizers | Acres | 223,924 | 22,354 | 3 |
| Rough tillage | do | 141,786 | 237,945 | 1,07 |
| Seeding and sodding | do | 771,323 | 97,123 | 1,82 |
| Weed control | | | 476,798 | 5,57 |
| Others | | | | |

WATER MANAGEMENT

| | | | | |
|---|------------|-----------|-----------|-------|
| Detentions | Cubic yard | 2,331,731 | \$470,391 | \$17 |
| Diversions | do | 1,633,713 | 139,296 | 20 |
| Ponds | do | 2,379,925 | 231,858 | 60 |
| Land leveling | Acres | 57,068 | 93,581 | 63 |
| Others | | | 462,536 | 2,30 |
| Operations and Maintenance ¹ | | | 424,962 | 8 |
| Total | | | 4,442,067 | 20,06 |

¹ Operation and maintenance of conservation structures and installations and recurring practices.

One conservation practice of particular importance is brush control, eradication, or suppression accompanied by natural or artificial revegetation. During 1958, this work was carried out, as indicated above, on 160,522 acres of Indian land. On some of the western Indian reservations over 90 percent of the lands are covered to some degree with desert-type shrub vegetation. Some important species are big sage brush, pinon pine, and juniper. Methods used in eradication depend upon the location, density, type and size of the brush and other factors. The three most common methods of brush eradication are aerial spraying with chemicals, cabling with large tractors and controlled burning. Where the brush is dense, burning is the most practical as well as the most economical method. The accompanying photograph was taken on the Hualapai Reservation in Arizona where 37,500 acres have been treated since 1953. This area was heavily infested with juniper and pinon pine, was burned about 10 years before the photograph was taken. After the area was burned it was seeded from an airplane with crested wheat grass, weeping



eration of brush has produced a healthy growth of forage on the Hualapai Reservation in Arizona.

grass, and yellow blossom sweet clover. As can be seen, the grass is excellent in the area at the present time, whereas before treatment there was very little, if any, vegetation for grazing.

The cost of brush eradication varies depending upon the type of equipment or method used. Controlled burning as used on the Hualapai Reservation costs from 3 to 10 cents per acre. Aerial seeding costs from \$3 to \$4.50 per acre depending upon the kind and amount of seed per acre applied. Prior to treatment of this land there was very little vegetation for grazing or for the protection of the land for erosion. The increase in grazing capacity as a result of brush eradication varies with many factors, the most important of which is available moisture. The heavier the density of brush to be eradicated and the greater the annual precipitation, the greater the increase in grazing capacity after brush eradication and replacement with grass. In areas such as that photographed, the grazing capacity has been increased at least tenfold.

AGRICULTURAL EXTENSION

The extension programs of the Bureau are educational and planned to help Indian people directly so they can better understand and solve their problems to improve their economic conditions. The value of

this educational work cannot always be measured by monetary returns. It can be seen, however, in the increased use being made of modern agricultural practices, improved quality of cattle, new and improved homes, and a higher standard of living.

A total of \$952,281 was available for the Bureau's 1958 Extension Program. Of this amount, \$519,000 was allocated for payment to State extension agencies for services provided under contract.

The Bureau's own extension workers—still active in Arizona, Mississippi, and part of New Mexico—are stressing strongly the culling of herds, greater care in the selection of breeding stock, and giving more attention to management and marketing. Many meetings and demonstrations have been held emphasizing disease control, reserve feed supply, and range improvement.

The table below gives in brief form the facts relative to the Extension program for the calendar year 1957 carried on by the Bureau extension workers.

| | Number |
|--|--------|
| Meetings held..... | 3,400 |
| Attendance at meetings..... | 75,000 |
| Farm or home visitations..... | 13,400 |
| Demonstrations conducted..... | 600 |
| Radio and TV broadcasts made..... | 100 |
| News articles prepared..... | 100 |
| Bulletins distributed..... | 12,000 |
| Indian housewives adopting new practices in home management, family economics, clothing, food, and nutrition, etc..... | 7,500 |
| Indian families participating for first time in Farm and Home Unit planning..... | 700 |
| Families having 4-H Club project directly supporting farm and home plans..... | 100 |
| 4-H Clubs..... | 100 |
| Total members enrolled..... | 1,750 |

ROADS

The 1958 Indian Bureau road program was authorized in the Federal-Aid Highway Act of 1956. The act included an annual contract authorization of \$12,000,000 for Indian Bureau road construction and maintenance during fiscal year 1958 and an identical authorization for fiscal 1959.

With \$2,650,000 available for road maintenance, the Bureau provided routine maintenance on about 17,400 miles of reservation roads and bridges in 20 States. In 1958, as in the preceding 2 years, Bureau roads in California were damaged by heavy floods, and this caused changes and delays in the construction program in that State.

On the construction side, obligations were incurred in 1958 totaling \$14,827,092. This includes contracts and other work which will pro-

in the aggregate for 5,201 feet of bridges, 416 miles of grading and draining, 448 miles of gravel surfacing, 230 miles of bituminous surfacing, and 690 miles of survey work and plans.

Under the established Bureau policy of building roads up to an acceptable standard and transferring them to a local governmental unit for maintenance wherever possible, the Bureau's nationwide road system was reduced in fiscal 1958 by 606 miles.

CREDIT ACTIVITIES

Economic activities of Indians were probably more adequately financed and more sources of financing were available to them at the close of 1957 than at any time in their history. The following shows the increase in the amount of financing received by them at the close of the past 5 years.

| | Customary credit chan- nels ¹ | Through Bu- reau | Total |
|--|--|---------------------|--------------|
| | \$22,315,851 | \$22,717,974 | \$45,033,825 |
| | 27,665,135 | 21,449,804 | 47,114,939 |
| | 33,959,558 | 27,149,696 | 61,109,254 |
| | 55,725,811 | 29,961,299 | 85,687,110 |
| | 59,424,956 | 30,344,983 | 89,769,939 |

Figures are as of Dec. 31 of preceding calendar year.

The increase of nearly 34 percent in 1957 over 1953 of financing received through the Bureau, was accomplished during a period when the cash balance of the revolving fund for loans by the United States was increased from \$4,014,821 to \$7,945,383, without additional appropriations.

Financing From Non-Bureau Sources

Financing of Indians through the same institutions serving other Indians is making progress. Loans by banks increased from an estimated \$6,530,127 in 1953 to \$10,971,235 in 1957. A memorandum of understanding was entered into during the year with the Federal Land Bank of Spokane for the financing of Indians. Similar memorandums had previously been entered into with the Federal Land Banks at Wichita and St. Paul.

Financing by the Farmers Home Administration has increased from \$308,455 in 1953 to \$1,695,916 in 1957. A revised memorandum of understanding between the Departments of Agriculture and the Interior was entered into during the year outlining procedures to be followed in making farm ownership, farm housing, soil and water, marketing, emergency, and special livestock loans to Indians.

Loans by production credit associations have increased from \$380,925 in 1953 to \$1,002,330 in 1957.

Building and loan associations loaned an estimated \$1,073,300 to Indians in 1957; insurance companies, \$268,191; the Rural Electrification Administration, \$266,435; cotton gin and seed companies, \$649,731; Federal Housing Administration, \$586,300; and finance loan companies, \$3,223,933. Miscellaneous other institutions financed Indians, and are included in the grand total of \$59,424,411. Bureau personnel assist Indian organizations in every way possible in obtaining justified financing through customary credit sources.

The act of March 29, 1956 (70 Stat. 62, 63), authorizing the extension and approval of mortgages and deeds of trust on individually owned trust or restricted land, is proving helpful to Indians in obtaining justified financing. To indicate the trend in this respect for the past four calendar years, the following is a summary of totals on a cumulative basis:

| Calendar year | Number | Amount |
|---------------|--------|-------------|
| 1954 | 36 | \$1,311,000 |
| 1955 | 56 | 2,111,000 |
| 1956 | 86 | 4,511,000 |
| 1957 | 103 | 5,111,000 |

Financing Through the Bureau

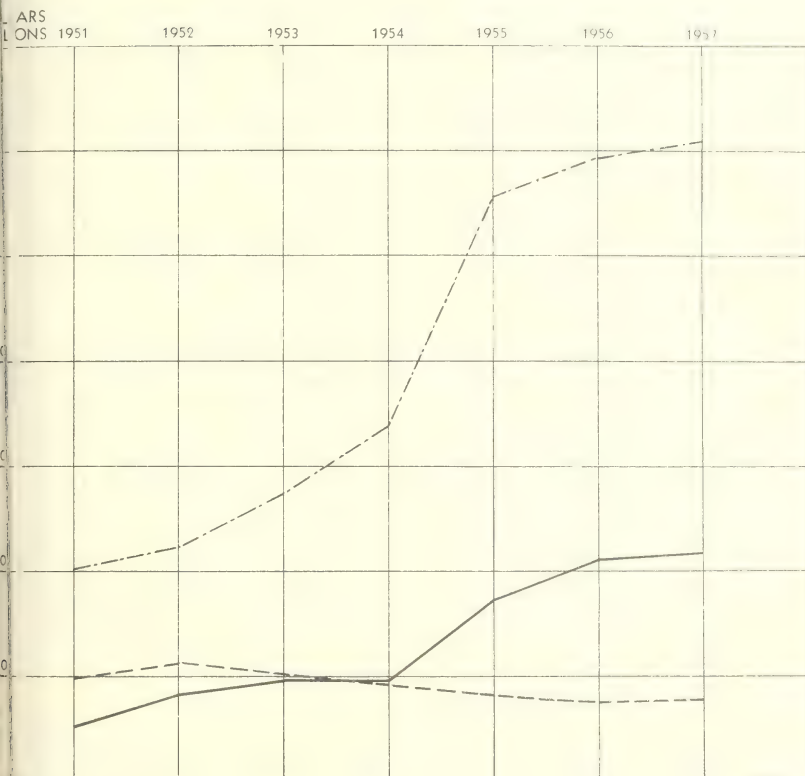
Two main funds are involved in financing through the Bureau: (1) tribal monies and (2) the revolving funds for loans appropriated by the Congress. In addition, two old credit programs are in process of liquidation: (1) so-called "reimbursable" loans which originated from appropriations made by the Congress during the years 1911-43 inclusive, and appropriations of tribal funds authorized by the Congress for tribal industrial assistance purposes and (2) loans for livestock repayable in kind.

The following shows the funds involved in the Bureau's program and the funds available for lending at the close of each of the past 4 years:

| | 1954 | 1955 | 1956 | 1957 |
|-----------------------|-------------|--------------|--------------|--------------|
| Tribal funds | \$9,669,468 | \$17,300,578 | \$21,216,542 | \$21,811,000 |
| R. C. F. loans | 9,505,193 | 8,311,374 | 7,715,612 | 7,911,000 |
| Reimbursable loans | 841,568 | 498,299 | 314,040 | 2,311,000 |
| Livestock loans | 1,433,575 | 1,039,445 | 715,105 | 2,511,000 |
| Total outstanding | 21,449,804 | 27,149,696 | 29,961,299 | 30,544,000 |
| R. C. F. cash balance | 5,280,016 | 6,904,964 | 7,832,979 | 7,911,000 |
| Total | 26,729,830 | 34,054,660 | 37,794,278 | 38,455,000 |

SUMMARY OF FINANCING RECEIVED BY INDIANS
AND THEIR ORGANIZATIONS

KEY: — · — · CUSTOMARY CREDIT CHANNELS (NON-BUREAU)
 — TRIBAL FUNDS
 - - - REVOLVING CREDIT FUND



Tribal Funds

The increased use of tribal funds to finance Indians, and financing received by them through customary credit channels, has reduced the demand for loans by the United States. The amount of tribal funds in use increased from \$21,216,542 in 1956, to \$21,875,815 in 1957. The actual increase in funds being used by some tribes is greater than those totals indicate. The 1956 total included \$586,156 of the Menominee Tribe which is not included in the 1957 figure due to terminal legislation (68 Stat. 252).

Revolving Loan Fund

The United States makes loans to tribes, other Indian organizations, and individual Indians. The additional amount loaned during 1957 was \$2,202,373. This amount has been exceeded in only 4 years since the revolving fund was established.

Repayments during 1957 were \$2,017,132, a decrease of \$410, from the amount received in 1956. However, repayments in 1957 almost equaled the \$2,029,346 collected from the time the first appropriation was made for the fund in 1936 through a period of the next 27 years.

The amount of loans receivable at the close of 1957 was \$7,900,837, an increase of \$185,241 over 1956. The following tabulation shows the amount of loans receivable by classes of borrowers at the close of the past 4 years:

| | 1954 | 1955 | 1956 | 1957 |
|--------------------------|---------------|---------------|---------------|---------------|
| Tribes..... | \$8, 016, 922 | \$7, 285, 050 | \$6, 836, 689 | \$7, 090, 837 |
| Credit associations..... | 1, 008, 829 | 615, 878 | 508, 791 | 450, 000 |
| Cooperatives..... | 53, 087 | 50, 387 | 44, 386 | 40, 000 |
| Individuals..... | 426, 355 | 360, 059 | 325, 746 | 300, 000 |
| Total..... | 9, 505, 193 | 8, 311, 374 | 7, 715, 612 | 7, 900, 837 |

Delinquent loans as of June 30, 1957, amounted to \$703,104 as compared with \$941,256 for the same period a year prior. The major delinquencies are on loans to villages in southeastern Alaska which were made to acquire and operate salmon canneries. Poor fishing seasons have caused heavy losses, and the loans by the United States to these villages are not in satisfactory condition.

Use of Funds by Relending Organizations

Loans of revolving funds by the United States and advances on tribal funds are used by Indian organizations to make loans to members and associations of members, and to finance tribal business enterprises. Repayments on loans made by organizations are available within the terms of their agreements with the United States, for additional loans. Activities during 1957 consisting of loans and investments in enterprises, loans to cooperatives and loans to individuals (cash) aggregated \$4,369,251. The unpaid balances at the close of the year were:

| | |
|-------------------|----------------|
| Enterprises..... | \$15, 055, 100 |
| Cooperatives..... | 715, 000 |
| Individuals: | |
| Cash..... | 6, 388, 000 |
| Livestock..... | 1, 213, 000 |
| Total..... | 23, 367, 000 |

BUDGET AND FINANCE

Further progress was achieved during 1958 in revision and improvement of the Bureau's integrated system of budgeting and accounting. As a natural product, the system provided supporting data upon which a cost-type budget was based. These data were included in the President's Budget for the fiscal year 1959. Improvement was also made in tying budgetary activities more closely to the organizational structure, which will facilitate the budget processes and provide more meaningful information directly related to program management.

The accounting functions performed by the Sacramento area office were transferred to the Phoenix area office in a move which is expected to increase efficiency through specialized use of finance personnel.

The Portland area office pilot operation for electronic accounting reporting was reviewed to determine whether similar operations could be feasible in other areas, where volume and conditions indicated that consideration is warranted.

Procedures were placed in effect during the year to enable trust funds of individual Indians at the Uintah and Ouray Agency (Utah) to be deposited in a commercial bank, thereby obtaining a greater interest yield per individual than has generally been obtainable through investment in Treasury Bonds. In addition to the interest earnings, a plan is considered as a thrift incentive.

At the Osage Agency, a revised machine procedure was installed which permits automatic recording of individual payments on ledgers in the quarterly per capita roll. This saves a second operation and accumulates information for preparation of income tax returns as well as for other purposes.

PERSONNEL

The Supervisory Training Program which was initiated in June 1957 has continued to operate on a Bureau-wide basis. Bureau supervisors at every level have participated in the program; conference leadership experience has been provided, and topics on human relations, personnel administration, and organization inter-relationships have been presented. Activities to encourage self-improvement of employees have been initiated and in-service training in specialized fields has been conducted. Orientation training for new employees has also been presented at all Bureau offices and installations.

In collaboration with the Tenth Civil Service Region, a simplified training program has been developed and placed into effect on a pilot basis within the Gallup and Phoenix areas. This has involved

the establishment of local Boards of Civil Service Examiners at Agency level, announcing examinations, as needed, for ungraded lower-grade classified positions which are not covered by appropriate Civil Service announcements or registers. The local board option will expedite the filling of positions covered in view of the simplified nature of the examining process, will make an opportunity for career-conditional appointments available to Indians and non-Indians selected, and will provide a means of converting the appointments of Indian preference eligibles currently serving in the excepted service to career-conditional status as their names are within reach. If the pilot program proves successful, the Bureau plans to explore the possibility of launching similar simplified examining programs in other areas of operation.

Classification standards were developed during the year for two types of positions, Dormitory Attendant and Agent Plant Manager. This was a major undertaking since the standards cover approximately 1,000 positions in the Bureau.

PLANT DESIGN AND CONSTRUCTION

For the fiscal year 1958, Congress gave general approval to a \$1,157,100 program for Indian Bureau buildings and utilities which included funds for advance planning as well as for construction of some facilities. The additional facilities to be built in accordance with these plans plus the current construction items add up to a potential construction program of \$67,571,000 to be carried out over a period of years. For carrying out this program in fiscal 1958, \$12,932,000 was appropriated.

Contracts with 35 architect-engineer firms were negotiated and awarded during fiscal 1958 for approximately \$1,208,400. A substantial part of the design work was accomplished by the Bureau's regularly employed staff of architects and engineers. Previously prepared plans and specifications were also adapted for use on some projects.

With funds available for advance planning of buildings and utilities, the Bureau will be able to obligate practically all of its appropriation for buildings and utilities during fiscal year 1959.

Fifty-five construction contracts were awarded in fiscal 1958, primarily for schools and related plant structures. Most of these are in isolated locations and will furnish educational facilities for approximately 1,697 additional Indian children when completed. Except for this construction, the Indian children in these locations would not be able to attend school at all because of lack of facilities.

Construction of 14 water and sewer projects was started during fiscal year 1958 and one new central heating plant was completed.

ing an existing plant which had been condemned as unsafe. In addition, construction was initiated on 215 living quarters for Bureau employees in isolated areas where no rental or other Government quarters are available.

The Bureau continued assisting the United States Public Health Service on its Indian health program both through architectural and engineering services and in connection with the construction of facilities.

PLANT MANAGEMENT

In 1958, information on the scope of facilities being operated and maintained by the Bureau was brought together on a more current basis. This includes data on the condition, capacity, and individual cost of each facility for maintenance and repair, with a view toward bringing the Bureau's plant management activities up to acceptable operating standards.

Information now available indicates that the Bureau's 7,800 individual buildings of various types (with a combined floor space of 19,000,000 square feet) and 8,000 utility systems are in many cases definitely antiquated and have an average age between 50 and 60 years.

To facilitate the management program, surveys to evaluate the condition of the Bureau's physical plants have been initiated and will continue as a function of the Branch of Plant Management.

Policy and procedural guidelines on the broad concept and technical considerations involved in the proposed fluoridation program recommended by the Public Health Service for adoption at Indian Bureau facilities have been issued.

A new program was initiated in 1958 for on-site inspections of boilers and power plants. This program is designed to assure that these plants and their equipment are being operated and maintained in accordance with established safety standards for pressure vessels and appurtenant equipment.

Continuing efforts are being made to dispose of telephone systems operated by the Bureau wherever this is feasible and economical.

Efforts are also being made to correct sanitation deficiencies uncovered by United States Public Health Service sanitary engineers during their inspection at Bureau installations and to eliminate unsafe conditions found at Bureau facilities by the Bureau's own safety engineers.

PROPERTY AND SUPPLY

In fiscal 1958, as the General Services Administration established 100 pools in Indian Bureau areas of operations, the Bureau in-

creased its participation in these motor pool systems with a definite gain in program efficiencies and administrative economy.

The Bureau has further reduced the size of its land holdings through sales of property conducted by the General Services Administration and by conveyances of acreages to public school districts, tribal groups in fee status, and to one State-operated school. Several Federal buildings, located on tribal lands, have also been conveyed to Indian tribal groups under authority of Public Law 991, 80th Congress (70 Stat. 1057).

Marked improvement has been made in property accounting by extending use of the mechanized property accounting system, and progress continues toward better planned procurement for the Bureau's widespread operations.

INTERNAL AUDIT

During 1958 audits were completed and reports were prepared for 9 of the 10 Bureau areas, all 12 field relocation offices, the office of Plant Design and Construction (in Albuquerque, N. Mex.) and the central office. In addition, audit assignments of a special nature involving cost studies, tribal operations and enterprises, and the logging operations of several privately owned lumber and pulp mills were completed.

The staff was at authorized strength during most of the year and this permitted a more comprehensive audit coverage.

MANAGEMENT COORDINATION

Organizational Changes

Two important organizational changes occurred during fiscal 1958. A Branch of Industrial Development was established in September 1957 in the Division of Economic Development, formerly the Division of Tribal Programs and Relocation Services. This Branch, charged with cooperating with industries which desire to locate on or near Indian reservations or to expand their present facilities in such areas, had established positions in most of the area offices by the end of the fiscal year and was rapidly establishing contacts with industries.

Effective July 1, 1958, jurisdiction over the Seminole Agency was removed from the Muskogee area office and placed directly under the central office. Difficult communications between the headquarters of the Agency in Dania, Fla., and Muskogee, Okla., and special coordination of industrial development and tribal government programs planned for the Seminole Tribe, necessitated this change.

Incentive Awards Program

Employee participation in the Incentive Awards Program continued to increase. The number of suggestions submitted (485) was nearly 50 percent more than that of fiscal 1957, and the savings resulting to the Government (\$65,345) was more than three times that of last year. An improved food distribution system in the Gallup area resulted in savings of \$71,000 during the first 6 months of fiscal 1958. Personnel of the Gallup Supply Center who devised this system received a Meritorious Unit Award for their achievement in expediting the delivery of foodstuff to approximately 100 Indian schools.

Reports and Forms Management Program

Manual instructions establishing control over requests for new and revised reports and for continuous review of current management reports were issued in fiscal 1958. While 10 percent more reports were eliminated and reduced in size or frequency, the expanding Bureau program has kept the report total unchanged.

Nearly a hundred new and revised forms were designed to fit into the more efficient, standardized pattern set up for Bureau forms. The annual review to eliminate obsolete forms was not completed at the end of fiscal 1958 but indications are that a further reduction of about 15 percent will be effected.

As part of the procedures for assembling necessary information, enumerations of the Indian population on the Navajo and Wind River Agencies were completed and an enumeration begun of Indians in Nevada. Data obtained from two former surveys and the enumeration in the Aberdeen area completed last year were summarized for general use. Special studies were made from these summaries to demonstrate their value in planning, appraisal, and management.

Food Service Program

The master menu installed in the Gallup area last year is being studied for extension to the Phoenix area and plans are being made to establish this procedure in other areas. Use of the master menu makes possible the planning of food purchases well in advance so as to take advantage of seasonal prices, permits balanced nutrition on a uniform basis, and the exercise of economical portion control.

The Bureau experimented with the use of precooked, packaged frozen foods at the Albuquerque Boarding School. Preliminary findings indicated that this method of meal preparation is economically and nutritionally sound.

INSPECTION

The Bureau's inspection program was established early in March 1955, as a means to promote and encourage high standards of conduct in the management of Indian affairs throughout the Bureau in line with the announced policies of the Department of the Interior. The inspection office is primarily responsible for the conduct of "accident type" inspections, general inspection inquiries, and team surveys. During the past year the staff visited a number of field locations and filed 13 reports with the Commissioner concerning various matters of inspection interest.

BUREAU OF LAND MANAGEMENT

Edward Woozley, *Director*



THE REMAINING AREAS of the Nation's vacant and unappropriated public domain lands—the property of all our citizens—are under the jurisdiction and management of the Bureau of Land Management. The Bureau was formally created on July 16, 1946, and many significant and measurable achievements have been made in programs for the sound use and conservation of our public lands and their resources. In the 12 years since the consolidation of the General Land Office (which dated back to 1812) and the then 12-year-old Grazing Service into the new Bureau of Land Management, much has been done to meet the growing demands for land and resource use—meeting the challenge of growing America.

The Bureau of Land Management (BLM) is responsible for vast lands and publicly owned resources, the ultimate value of which is immeasurable. The Bureau has the sole responsibility for the conservation and sound use of more than 475 million acres of public lands. About 298 million acres of these lands are in Alaska. Most of this is unreserved and unappropriated. These lands are usually called the vacant public domain, though here “vacant” does not mean the lands are not being used or that they have no value. They are very important and may have value as sites for farms, homes, towns, parks and other public areas. They are used for grazing sheep and cattle, for mineral exploration and development, for forest and timber production, and many other purposes.

The Bureau of Land Management also manages the mineral resources on about 58 million acres of lands now in private ownership of which the Federal Government still owns the mineral rights. BLM also handles mineral leasing on millions of acres of offshore submerged lands on the Outer Continental Shelf.

In addition, the Bureau administers the mining and mineral leasing laws in another 242 million acres of federally owned lands, the prin-



In recent years the use of ship anchor chains in removing sagebrush and other undesirable plants from public rangelands has been developed into a successful range improvement practice. Some 540 feet of Destroyer anchor chain, weighing 35 pounds per foot, drawn in a loop by two D-8 crawler tractors removed the brush from a 200-foot swath in one pass.

principal management responsibility of which rests with other agencies. This includes the administration of mineral resources in the national forests of the Department of Agriculture and others.

In taking care of the public lands, the big job of the Bureau of Land Management is Conservation—to use the land and natural resources wisely, to prevent waste, and to rebuild and improve our public lands.

This summary of the principal accomplishments for the fiscal year ending June 30, 1958, reflects the Bureau's policies and programs for the conservation, management, and development of the public lands.

LANDS

As the United States continues to grow in population and economic wealth, new and competing demands for land and resource use appear in the Bureau's lands programs and operations.

The demands take many forms, including lands for homes and cabins, lands for public parks and recreation areas, and lands for a wide variety of other uses.

Lands Legislation

Legislative activities during the year were an important part of the administration of the public lands. Enacted laws, and other legislation under consideration, reflect the interest of the Executive Branch and the Congress in furthering land resource development and multiple use management to aid economic growth, and the simplification of the public land laws to facilitate better public administration.

One of the major legislative developments during the year was the passage of a law (Public Law 85-337, approved on February 28, 1968) which requires that all future military land withdrawals over 100 acres be approved by specific acts of Congress.

Public Law 337 also provides for Department of the Interior administration of resources on military land withdrawals. When consistent with the terms of the withdrawal and the use of the withdrawn lands, the development of the mineral resources will be permitted under management by the Department. The law also provides for the management of wildlife resources, including hunting and fishing, under applicable State and Federal laws.

This law provides the Congress with opportunity to examine closely the need, use, size, and local and national effects of withdrawals, consistent with defense and military needs. The act and the testimony given at the Congressional hearings emphasize the principles of multiple-use land management.

Other new laws will aid in the administration and proper development of the public lands. Public Laws 225 and 233 clarified the Secretary's authority to transfer to Alaska title to recreational sites developed by the Bureau of Land Management under Public Law 567. 84th Congress, and public works sites developed under the Alaska Public Works Act. Alaska tidelands fronting on townsites were transferred to the Territory by Public Law 303.

Congress and the Department had under consideration other important proposals for further improvement of the basic public land legislative structure. These included amendment of the indemnity school land laws to remove inequities and to stimulate closing of accounts; legislation to authorize the lease or sale of urban, industrial and townsites; limited authority for conveyance of portions of unperfected railroad rights-of-way; townsites and rights-of-way in national forests; and preservation of wilderness areas.

Regulations and Procedures

Within the context of legislative authority and direction, the operating policies, programs, and procedures for the administration of



Restoration of bunch grass 1 year after the brush was removed by anchor chain

the public land laws are spelled out in the official Interior Department Regulations (published as part of the United States Code of Federal Regulations). They are an important part of the Bureau's land and resource management program. New regulations proposed and adopted during the year included the following:

In formal regulations (published as Circular 1992) the Secretary provided that every patent (title document) under the Recreation and Public Purposes Act of 1954 will contain a clause to prohibit discrimination because of race, creed, color, or national origin on all lands obtained under that act. Penalty for violation of the clause is loss of the land—and the money paid for it.

Regulations governing the selection by Alaska of areas under the land grant provisions of the Mental Health Enabling Act were published as Circular 1994. A significant provision in these regulations protects settlers in Alaska from loss of rights in or from inadvertent settlement on lands desired for selection.

Lands Adjudication

During fiscal year 1958 the Bureau of Land Management received approximately 21,132 new applications for the use or acquisition of public lands. The comparable figure for 1957 was 22,808. During

the year 41,110 cases were closed. As of June 30, 1958, there were 1,725 unclosed cases pending. The preceding year there were 51,387. The number of new small tract applications dropped sharply in 1958. There were 5,657 applications filed in fiscal year 1958 as compared with 10,759 in 1957 and 32,304 in the peak year 1955. This trend is largely due to the temporary closing of all of San Bernardino, Riverside, and Imperial Counties in California and large portions of Kern County to applications under the Small Tract Act until efficient and satisfactory areas are classified for small tracts.

Areas of intense small tract interest in other States such as Arizona and Colorado were also closed to application to facilitate orderly disposition without undue delay. In addition, Clark County, Nev., remained closed to permit the resolution of conflicts among competing applications and the development of plans for disposition of the public lands. These actions permitted the Bureau to concentrate on processing pending applications. Accordingly, the number of unclosed small tract cases remaining at the close of 1958 was reduced to 25,641.

Public auctions followed immediately by the issuance of patents have been used increasingly to make land available for occupancy under the Small Tract Act. Auctions were held not only for terminated-lease tracts, but also for newly classified tracts where States or local governments have assumed the duty of regulating minimum leasing standards. During the year 6,740 small tract patents were issued, covering 27,240 acres. As of June 30, 1958, 28,454 small tract leases were in effect on approximately 116,738 acres.

Classification and Investigation

One of the most important tools of the Bureau of Land Management in reconciling and balancing all of the potential uses of the public lands is a process called land classification. This program, authorized by Section 7 of the Taylor Grazing Act of 1934 and by other laws, provides for the examination and classification of lands to their highest use or best tenure—grazing, farming, mineral development, homesites, and so forth.

Classification of the land is a necessary forerunner to all types of final disposition of public lands in the States, except in certain cases where Congress has specifically provided otherwise. The procedure assures that final disposition of the public lands will be in the public interest.

The largest number of classification and investigation operations were made in connection with application under the Small Tract Act. This law authorizes the lease or sale of small parcels of vacant

public lands for recreation, residence, business and community service purposes. A total of 11,091 small tract classification and investigation cases were handled during the year, with the largest interest activity in California. Approximately 19,409 acres were classified for small tracts by the Bureau during the year; 127,408 acres were so classified and published in the Federal Register a year ago.

A summary of Bureau of Land Management classification and investigation operations follows:

TABLE 1.—*Classification and investigation operations, Bureau of Land Management, fiscal year 1958*

| Type of case | Cases pending July 1, 1957 | New cases | Cases closed | Cases pending July 1, 1958 |
|-------------------------------------|-------------------------------|-----------|--------------|-------------------------------|
| Land cases: | | | | |
| Classifications and investigations: | | | | |
| Homesteads..... | 227 | 310 | 322 | |
| Desert land entries..... | 593 | 1,415 | 1,283 | |
| Small tracts: | | | | |
| Sales..... | 503 | 4,427 | 4,150 | |
| Leases..... | 18,432 | 4,514 | 6,941 | 16,000 |
| Public sales..... | 1,631 | 1,300 | 1,566 | 1,300 |
| Selections..... | 323 | 216 | 379 | |
| Exchanges..... | 437 | 297 | 468 | |
| Rights-of-way..... | 77 | 1,106 | 1,116 | |
| Compliance..... | 577 | 1,263 | 1,519 | |
| Land trespass..... | 252 | 252 | 315 | |
| Withdrawals and reservations..... | 240 | 243 | 209 | |
| Revocations and restorations..... | 215 | 264 | 262 | |
| Other land title cases..... | 496 | 303 | 407 | |
| Other leases..... | 33 | 42 | 37 | |
| Other permits..... | 144 | 255 | 307 | |
| Other land investigations..... | 490 | 894 | 1,087 | |
| Total land cases..... | 24,670 | 17,101 | 20,368 | 21,400 |
| Mineral cases: | | | | |
| Classifications and investigations: | | | | |
| Applications..... | 100 | 125 | 118 | |
| Area and case classifications..... | 624 | 975 | 1,018 | |
| Mining locations..... | 2,207 | 6,444 | 4,396 | 4,200 |
| Other case conflicts..... | 19 | 18 | 18 | |
| Mineral trespass..... | 12 | 120 | 116 | |
| Other mineral investigations..... | 201 | 682 | 567 | |
| Total mineral cases..... | 3,163 | 8,364 | 6,233 | 4,200 |
| Grand total..... | 27,833 | 25,465 | 26,601 | 25,600 |

Mounting interest in public lands in southern California applied for under the Desert Land Act has magnified the already complicated problem of land classification in that area arising from competing applications for land under a variety of public land laws. The examination and classification of lands pursuant to applications filed under the Desert Land Act and the attendant adjudicative action are detailed and complex. In 1958 3,818 applications under the Desert Land Act were filed with the Bureau, as compared with 1,357 in 1957. The Bureau is pushing its campaign to resolve the conflict and reduce the backlog of pending applications.

The intensified demand for land is also reflected in the increased efforts by the various public land States to complete selections in satisfaction of the many land grants made to them by Congress and

take indemnity for State lands within the boundaries of Federal reservations, through lieu selections or State exchanges. Planned programs were intensified by the Bureau for early completion of selections made by several States, including Arizona, New Mexico, Minnesota, and Washington.

TABLE 2.—*Adjudication of lands cases, Bureau of Land Management, fiscal year 1958*

| Type of case | Cases pending July 1, 1957 | New cases | Reopened cases | Cases closed | Cases pending July 1, 1958 |
|------------------------------------|----------------------------|-----------|----------------|--------------|----------------------------|
| Replacements..... | 1,618 | 1,425 | 1,905 | 2,990 | 1,958 |
| Reclamation entries..... | 4,161 | 3,818 | 1,154 | 2,303 | 6,830 |
| Public sales..... | 3,072 | 2,099 | 231 | 2,096 | 3,306 |
| Tracts: | | | | | |
| Lease-purchase..... | 4,386 | 103 | 8,694 | 5,725 | 7,458 |
| Lease sales..... | 610 | 529 | 19 | 1,049 | 109 |
| Leases..... | 28,928 | 5,657 | 7,841 | 16,785 | 25,641 |
| Licenses..... | 1,131 | 508 | 43 | 558 | 1,124 |
| Permits..... | 966 | 426 | 147 | 570 | 969 |
| Land title cases..... | 2,720 | 3,379 | 887 | 4,057 | 2,929 |
| Mineral leases..... | 133 | 88 | 50 | 122 | 149 |
| Right-of-way..... | 1,473 | 1,641 | 1,427 | 2,463 | 2,078 |
| Mineral land permits..... | 644 | 605 | 706 | 1,244 | 711 |
| Mineral resource sales..... | 65 | 211 | 98 | 290 | 84 |
| Withdrawals and reservations..... | 1,089 | 343 | 95 | 546 | 981 |
| Reclamations and restorations..... | 391 | 300 | 19 | 312 | 398 |
| Total..... | 51,387 | 21,132 | 23,316 | 41,110 | 54,725 |

State lieu selection programs started when the first grant of school sections was made to Ohio in 1803. This phase of the public land history now appears to be drawing to a close. The current activity by the States, the incentives in S. 2517 to complete selections, and the provisions of the Alaskan Statehood legislation substituting quantity grants for grants of school lands in place, all point to a foreseeable end to State indemnity selections.

Withdrawals and Restorations

Withdrawals of public lands in the United States and Alaska during the year totaled 3,599,284 acres while restorations aggregated 3,644 acres.

Better ways of processing of land withdrawals and restorations are being used, including (1) adoption of new regulations to standardize classification and processing of withdrawal requests, (2) establishment of inventory controls over withdrawal applications and restoration requests, and (3) organization of a systematic review of all present requested withdrawals and reservations.

Recreation Land Use

Under its newly announced public recreation land use policy, the Bureau launched a cooperative program with local, State, and Na-

tional governmental agencies to bring about much more recreation development on unreserved public lands. Increasing population, income, travel, urbanization, and leisure made this emphasis in land policy both necessary and urgent.

Scattered through the public domain under the Bureau's jurisdiction are possibly several million acres, which may be suitable for intensive public recreation use. In classifying land, the Bureau considers not only the recreation values of all of these lands but pays particular attention to ocean coastal frontage and shores of inland waters and attendant access lands.

Vacant and unreserved land suitable for public recreation areas and not needed for multiple use purposes ordinarily will be made available for purchase by State or local agencies under the Recreation and Public Purposes Act. Under it, land is made available on conditions and terms which insure use for public recreation and which establish prices that give full consideration to the use of the land for public purposes. Suitable sites having important multiple use values which should be retained in Federal ownership under Bureau Land Management administration generally will be made available to State or local agencies by lease, permit, or agreement. Where lands are found to be valuable for national recreation use, appropriate Federal agencies may make application for the withdrawal and reservation of the land in the public interest.

In western Oregon over 2 million acres of O. & C. forest lands in organized timber management areas are to be administered not only to protect and improve their recreational values but also to facilitate their recreational use. Since the Recreation and Public Purposes Act is not applicable to them, the Bureau will encourage State and local governmental agencies and nonprofit organizations to develop, operate, and maintain public recreational areas under leases, permits, or other suitable arrangements.

In cooperation with the National Park Service, the recreation potential of the public lands is being inventoried. On O. & C. lands this involves examination of lands having recreation potential by the National Park Service where roads, power lines, or other developments are contemplated.

Under Public Law 507 (act of May 4, 1956, as amended) the Bureau has undertaken development of recreation sites in Alaska. The sum of \$100,000 was authorized to be appropriated for each of the fiscal years 1957-61 for site development. One hundred and six sites are planned for improvement over that period. The sites are distributed along the 3,400-mile connected highway system and closely follow the National Park Service Recreation Survey of Alaska. So far 47 sites have been improved as of June 30, 1958.

Public Law 507 also provides that recreation sites as developed may be permanently transferred to Alaska or local communities. Alaska and the communities concerned will be encouraged to accept transfer of the developed sites.

In the continental United States, 156 sites involving 20,406 acres of public land were classified during 1958 under the Recreation and Public Purposes Act. In addition, patents were issued for 51 park and recreational sites during the year.

MINERALS

This Bureau is charged with the administration of the mineral leasing and mining laws on an area equivalent to more than one-third of the total combined land area of the continental United States and Alaska. Sound use of these nonrenewable natural resources is essential both to the national economy and security of the Nation in times of peace or emergency.

Accomplishments

Mineral activities under the Bureau's administration continued to increase both in volume and revenues received by the Government. With the exception of leasing on the Outer Continental Shelf, all phases of the minerals program showed an increase for the past year. Gross receipts by the Federal Government from royalties, rentals (including those from the Outer Continental Shelf), and bonuses from competitive oil and gas leases and other mineral leasing totaled \$369,101.95 in fiscal year 1958. Receipts in 1957 were \$83,396,000.33. No new competitive leasing was done in the submerged lands of the Outer Continental Shelf, pending final decision by the United States Supreme Court on the boundary questions contained in *United States v. Louisiana, et al.*

Legislation, Regulations, and Procedures

During the fiscal year legislation was enacted and numerous regulations, procedures, and orders were issued to facilitate and expand the Bureau's minerals program and to promote the sound use and conservation of these resources.

The act of August 12, 1957 (71 Stat. 341) removed the restriction that no person, association, or corporation shall hold phosphate leases exceeding 5,120 acres in any one State at any one time. The law still provides, however, that not more than 10,240 acres in the United States may be held under phosphate leases at any one time by a person, association, or corporation.

Final phosphate regulations under the act cited above were published in the form of Circular 1986 on November 14, 1957.

The Alaska coal regulations and those for the States were amended on November 14, 1957, and March 15, 1958, respectively, eliminating the necessity for detailed citizenship statements from individual applicants. Also eliminated was the requirement that corporations must file certified copies of their articles of incorporation. The new regulations require individuals to submit, as proof of citizenship, a statement as to whether they are native born or naturalized and for corporations to file statements of their qualifications, including citizenship and holdings of individual stockholders.

The coal regulations were also amended on May 13, 1958 (as Circular 2001), so the cost of publication of notices of coal lease offers may be held to a minimum. The amendment provides for publication of only general information regarding lease offers, along with information about where the detailed terms and conditions of lease offers may be obtained.

Mineral Leasing on Federal Wildlife Lands

On January 8, 1958, the Secretary of the Interior signed new regulations for oil and gas leasing on Federal wildlife lands. A public hearing on the proposed new rules had been held in Washington, D. C. on December 9, 1957.

The regulations established departmental policy and procedure dealing with oil and gas leasing on public lands reserved for wildlife conservation purposes.

The regulations recognize four separate classes of wildlife lands. These include wildlife refuges, game ranges, Alaska wildlife areas, and Federal-State cooperative lands. The latter category includes lands made available to the States through joint agreements between the Federal Government and State game commissions.

Under the regulations, all oil and gas leasing is forbidden on Federal Wildlife Refuge under jurisdiction of the Fish and Wildlife Service, except where it is conclusively determined that public lands are being drained of oil and gas by nearby wells.

If the Geological Survey determines that those lands are subject to oil drainage from operations on adjacent lands, the Bureau of Land Management may, upon concurrence of the United States Fish and Wildlife Service, process an offering inviting competitive bidding. Leases for such lands will be issued only upon approval of the Secretary of the Interior and would contain specific stipulations which would be necessary to insure fully that oil and gas development would not damage wildlife resources.



Various cattle grazing on tidal flat winter pasture on a Bureau of Land Management grazing lease, Kodiak Island, Alaska. These tidelands are essential to provide yearlong grazing for Kodiak livestock.

On game-range lands, administered jointly by the Bureau of Land Management and the Fish and Wildlife Service, the two agencies are responsible for determining any area that would not be subject to oil and gas leasing. Under the regulations these special areas would be treated the same as lands in an established wildlife refuge. The remaining lands in each game range would be open to oil and gas leasing under such conditions as are determined necessary to insure that leasing activities and drilling will not interfere with the value of lands for game-range purposes. Under the regulations, areas that are closed to oil and gas leasing within a game range are estimated 4,609,000 acres.

Oil and gas leasing on Federal-State cooperative lands and on Alaska wildlife areas would be handled under the same principles as game range lands. Any areas in which leasing would be forbidden, except when there is drainage present, will be determined by the agencies having jurisdiction over the lands. The remaining lands in these areas would be open to oil and gas leasing under such stipulations as are deemed necessary to protect wildlife resources. There are approximately 638,651 acres in Federal-State cooperative lands and about 7,784,000 acres within Alaska wildlife areas.

Permanent protection of wildlife values are contained in new leasing stipulations, approved April 18, 1958, providing for orderly development of oil and gas deposits under Federal wildlife lands.

The stipulations, which lessees must meet, apply to Alaska wildlife lands, game ranges in the States, and coordination lands.

The Secretary or Under Secretary of the Interior can grant waivers from terms of the stipulations in cases where the lessee can prove the conditions are unnecessarily burdensome and not necessary to wildlife protection.

Lessees must submit operation plans for approval prior to conduct of geological, geophysical or core drilling operations or construction of any facilities. The plans must show in detail how the lessee will comply with the stipulations.

Alaska

On January 29, 1958, Secretary Seaton approved a classification of the Kenai Moose Range in Alaska which delineates those areas which will be opened and closed to oil and gas development. The closed section—about 1,689 square miles—includes all areas on which the Fish and Wildlife Service believes oil and gas development would be incompatible with wildlife management.

In those areas of the Kenai Moose Range open to oil and gas leasing—about 1,525 square miles—operations will be subject to stipulations which provide maximum protection for fish and wildlife.

An extremely significant development in the Alaska mineral program was the discovery of oil in Alaska on July 23, 1957. The discovery was made in the Swanson River unit area on the Kenai peninsula.

Oil and gas leasing in Alaska has more than tripled during the past fiscal year, with an increase in outstanding leases from 3,385 to 9,191 and an increase in lease acreage from 6,516,746 to 19,552,900.

On April 18, 1958, Secretary Seaton signed an order that will permit future oil and gas leasing and staking of mining claims on approximately 20 million acres of northern Alaska public lands. The lands are in the area known as "PLO 82" (Public Land Order 82) in far northern Alaska above the Arctic Circle.

It modified the 1943 order establishing "PLO 82" and will make it possible to go ahead with plans to open certain parts of the land to oil and gas leasing.

Under the terms of his order approximately 16,000 acres of the lands in the PLO 82 area are located within the known geological structure of the Gubik Gas Field and were to be offered for leasing in 640-acre blocks through competitive bidding. The Department was also to publish a notice opening to oil and gas leasing, in blocks of 2,560 acres each, approximately 4 million acres outside of the Gubik Gas Field which will be available without competitive bidding.

The area embraced by the order was to be open to the staking of mining claims on September 1, 1958. (Actual leasing operations were undertaken not long after the end of the fiscal year.)

All Alaska oil and gas leasing was temporarily suspended on May 2, 1958, pending disposition of legislation (H. R. 8054) which would raise oil and gas leasing land rentals and royalties to the same level as those charged elsewhere in the United States. The measure (which passed) also authorized leasing of oil and gas lands beneath nontidal navigable waters.

Other Mineral Activities

During the past year, the Bureau made substantial progress under Public Law 167 which provides for the multiple use of surface resources on public lands under location as unpatented mining claims. Under the Bureau's program of selective examination, most high priority areas, where there was an immediate need to determine the Government's right to manage and dispose of the vegetative resources, have been examined. Hearings will be scheduled where necessary to determine the respective rights of the claimants and the Government. Under this program, the Bureau examined and published notices of surface rights determinations on 16,003,853 acres of combined Forest Service and Bureau of Land Management lands. This involved an estimated 10,098 mining claims.

Bureau activities under the mining laws continued at approximately the same level for patent examinations; 265 cases were closed; 53 new applications were received; and 120 patents were issued for approximately 22,404 acres.

Adjudication of Mineral Cases

Table 3 shows the number of mineral cases adjudicated by the Bureau during fiscal year 1958. For data on minerals investigations and classifications see table 1, page 252.

RANGE MANAGEMENT

The Bureau of Land Management must constantly work to improve its management and conservation programs on the Federal range lands, to assure adequate supplies of meat, wool, and leather, now and in the years to come.

Institution of a new formula for the determination of public-land grazing fees was a highlight of the past year. It bases fees on livestock prices paid the growers which are furnished to the Bureau at

TABLE 3.—*Adjudication of minerals cases, Bureau of Land Management, fiscal year 1958*

| Type of case | Cases pending July 1, 1957 | New cases | Reopened cases | Cases closed | Cases pending July 1, 1958 |
|-----------------------------------|----------------------------|-----------|----------------|--------------|----------------------------|
| Public domain lands: | | | | | |
| Oil and gas leases: | | | | | |
| Noncompetitive | 12, 828 | 47, 931 | 29, 762 | 72, 093 | 18 1 |
| Competitive | 74 | 58 | 141 | 222 | |
| Mineral leases | 239 | 59 | 274 | 345 | 2 |
| Mineral permits | 1, 587 | 1, 872 | 801 | 2, 388 | 1 3 |
| Mineral patent applications | 532 | 188 | 92 | 265 | 5 |
| Other mineral locations | 50 | 566 | 1, 118 | 766 | 1 |
| Acquired lands: | | | | | |
| Oil and gas leases: | | | | | |
| Noncompetitive | 2, 444 | 3, 015 | 1, 705 | 4, 792 | 2 1 |
| Competitive | | | 2 | 2 | |
| Mineral leases | 237 | 12 | 71 | 115 | 2 |
| Mineral permits | 1, 113 | 139 | 295 | 574 | 1 |
| Public domain and acquired lands: | | | | | |
| Oil and gas assignments | 3, 596 | | 32, 053 | 30, 023 | 5 5 |
| Resource sales | 33 | 20 | 14 | 52 | |
| Outer Continental Shelf leases | 31 | 1 | 62 | 77 | |
| Total | 22, 764 | 53, 861 | 66, 390 | 111, 714 | 31 3 |

TABLE 4.—*Areas leased and bonuses received, competitive mineral leases, Bureau of Land Management, fiscal year 1958*

| Type of mineral and State | Public domain lands | | Acquired lands | | Total | |
|---------------------------|---------------------|-----------------|----------------|----------------|--------------|-----------------|
| | Acres leased | Bonus received | Acres leased | Bonus received | Acres leased | Bonus received |
| Oil and gas: | | | | | | |
| Colorado | 4, 401. 51 | \$136, 618. 91 | | | 4, 401. 51 | \$136. 61 |
| Louisiana | 118. 65 | 2, 284. 64 | | | 118. 65 | 2. 28 |
| Montana | 159. 76 | 80. 20 | | | 159. 76 | 80. 20 |
| New Mexico | 626. 00 | 37, 566. 00 | | | 626. 00 | 37. 56 |
| North Dakota | 683. 07 | 257. 39 | | | 683. 07 | 257. 39 |
| Wyoming | 4, 574. 57 | 97, 625. 13 | | | 4, 574. 57 | 97. 62 |
| Total oil and gas | 10, 563. 56 | 274, 432. 27 | | | 10, 563. 56 | 274. 43 |
| Coal: | | | | | | |
| Colorado | 40. 00 | 40. 00 | | | 40. 00 | 40. 00 |
| New Mexico | 160. 00 | 160. 00 | | | 160. 00 | 160. 00 |
| North Dakota | 280. 00 | 320. 00 | | | 280. 00 | 320. 00 |
| Oklahoma | 240. 00 | 1, 120. 00 | | | 240. 00 | 1, 120. 00 |
| Utah | 8, 259. 09 | 8, 842. 00 | | | 8, 259. 09 | 8, 842. 00 |
| Virginia | | | | 237. 65 | | 237. 65 |
| Wyoming | 6, 395. 66 | 8, 694. 08 | | | 6, 395. 66 | 8, 694. 08 |
| Total coal | 15, 374. 75 | 19, 176. 08 | | 237. 65 | 15, 374. 75 | 19, 176. 08 |
| Other minerals: | | | | | | |
| Potash: | | | | | | |
| New Mexico | 1, 840. 00 | 1, 867, 340. 00 | | | 1, 840. 00 | 1, 867, 340. 00 |
| Sodium: | | | | | | |
| Wyoming | 11, 663. 41 | 40, 278. 26 | | | 11, 663. 41 | 40, 278. 26 |
| Mica: | | | | | | |
| Georgia | | | | 40. 00 | | 40. 00 |
| North Carolina | | | 9. 50 | 20. 00 | 9. 50 | 20. 00 |
| Limestone: | | | | | | |
| Florida | | | 80. 00 | 400. 00 | 80. 00 | 400. 00 |
| Gravel: | | | | | | |
| Michigan | | | | 13. 20 | | 13. 20 |
| Total other minerals | 13, 503. 41 | 1, 907, 618. 26 | 89. 50 | 473. 20 | 13, 592. 91 | 1, 908, 104. 46 |
| Grand total | 39, 441. 72 | 2, 201, 226. 61 | 89. 50 | 710. 85 | 39, 531. 22 | 2, 201, 937. 46 |

beginning of each calendar year by the Agricultural Marketing Service of the Department of Agriculture. In 1958 the formula led to a grazing fee of 19 cents per animal-unit month, an increase of about 25 percent over the 1957 fee.

General Range Conditions

In general, the 1957-58 grazing year was characterized by an exceptional growth of forage. Winter desert forage conditions were excellent in northern California and the growth of annual vegetation resulted in an almost unlimited amount of ground feed. In San Bernardino County the abundance of feed created a fire hazard in many desert areas.

The 1958 season began with excellent moisture conditions in Oregon, although a later spring resulted in unfavorable growing conditions during the critical spring period. Indications point to a somewhat better-than-average year in most Oregon districts, however. In Arizona, and the southern portions of Utah and Nevada annual plants made phenomenal growth and perennials began to rebuild or lost during the drought period. Browse plants in particular are making rapid recovery.

The drastic results of drought years in New Mexico resulted in grazing use being held to a conservative level and in general grazing utilization was light. It probably will take a number of years for the perennial grasses in that State to recover from the effects of continued drought, during which the density of the grasses was reduced. Drought conditions were recurring in northeastern Montana, where ranges were dry and stock water became critical, but forage range conditions in the remainder of the State were fair to good. In western Colorado desert ranges very little spring growth was made by forage plants due to drought. Generally, however, prospects were for ample feed, providing favorable grazing conditions on Federal range lands.

Condition of Livestock and Trend in Numbers

Abundant forage supplies and mild winter conditions generally found livestock on Federal ranges in far better condition than in previous years. Winter losses were at a minimum. The current trend in livestock numbers is upward, with a tendency of range operators to exercise non-use privileges. Last year's grasshopper infestations in northeastern Montana and livestockmen have reduced the numbers in that part of the State.

Range Adjudication

Progress on the adjudication and adjustment of grazing privileges continues at a steady rate, and the re-examination of grazing capacities and permitted use by livestock has resulted in critical areas being adjusted to proper stocking. Range areas are being planned on a more sound basis for continued stabilized grazing operations by establishing seasons of use which allow for forage development as well as the number of livestock which available feed would sustain. In some areas existing term permits have been amended to reflect adjustments made in range land allotment boundaries and grazing capacities.

Dependent property surveys are being made in conjunction with the adjudication program and completed in advance of re-evaluation of grazing capacities and the determination of proportionate allocation of feed available on a range area.

When drought conditions have caused a reduction in the allowable grazing use, range survey rechecks have become increasingly important. In areas previously adjudicated and within estimated grazing capacities, inventories of base property (range users' land and water upon which the extent of grazing privileges are based) have been brought current prior to the reissuance of 10-year permits. Management plans are being made in line with the new data and information.

Range Use Supervision

During the year a comprehensive Bureau policy statement was issued directed toward reducing trespass to a minimum through adequate range supervision. Increased attention has been directed toward obtaining livestock counts on allotments where range utilization appears excessive and intensive efforts were made to secure counts in problem areas. It was observed that feed lot counts appear to have had a marked effect on the lessening of trespass use.

Section 15—Administration

The lease regulations which implement Section 15 of the Taylor Grazing Act, which deals with vacant public lands not included in the grazing districts but considered suitable for grazing, were revised in the past year to improve administrative procedures.

The new regulations provide that before any application for disposition is allowed, evidence must be furnished that the applicant has agreed to compensate the lessee and the United States for any grazing improvements placed on the lands under the authority of the lease. They also provide that failure to comply with the terms

a cooperative agreement entered into with the Bureau shall be cause terminate a lease. Authority for establishing grazing lease rental was delegated to the Director under the revised regulations.

Alaska Grazing Resources

With the rapid expansion of the reindeer industry in Alaska, the Secretary delegated to the Director of the Bureau of Land Management authority to issue leases to Alaskan Eskimos and Indians for reindeer grazing on public lands in Alaska. To be sure that leased areas will not conflict with wild caribou migration routes, the Bureau will consult with officials of the Bureau of Indian Affairs and the Bureau of Sport Fisheries and Wildlife before issuing the grazing leases.

It is expected that better management of domesticated reindeer, as well as security of tenure on specified areas of sufficient size to carry on an economic operation, will ultimately result. However, Government management of the herds has been and will continue to be largely under the jurisdiction of the Bureau of Indian Affairs. Wild herds of reindeer are classed as big game animals, subject to management and control by the Bureau of Sport Fisheries and Wildlife.

Wildlife Management and Recreation

The Bureau and the Fish and Wildlife Service, after completing a comprehensive study of the range and related resources on Kodiak Island, jointly proposed an adjustment of the Kodiak Wildlife Refuge boundaries to enlarge that part of Kodiak Island devoted to grazing use and to exclude the grazing by domestic livestock from the 1-mile strip around the island. Accordingly, by Secretarial Order, the east boundary of the refuge was changed to increase the area outside the refuge which is available for cattle grazing and other purposes. The adjustment will result in reducing the zone of possible conflict between bears and livestock. The area now available for livestock is believed to have a high potential for grazing use due to climate, terrain, and proximity to processing and transportation facilities, and will serve as a further inducement to the establishment of a livestock industry in Alaska.

Bureau field offices are both initiating and participating in an increasing number of cooperative wildlife enclosure studies in which the utilization of range forage by wildlife and by livestock is being determined. These studies will provide basic information for herd adjustments and improved management practices.

Range Improvement

The 25 percent increase in grazing fees, effective January 1, 1947, resulted in an increase in the funds returned to the grazing districts for range improvements.

Maintenance of existing projects to keep them in good repair and in operating condition continued to receive first consideration in the range improvement program. A large part of this work, however, is done by the range users, so that the diversion of funds toward the completion of some new projects under this program such as fencing, water development, truck trails, and rodent control work was not possible.

The increased requests for fencing projects reflect the trend of range users toward better management. Their cooperation has been evidenced by the furnishing of material, labor, and funds in the construction and maintenance of range facilities. In addition, they have completed much range improvement work, financed entirely from private funds authorized by permits issued under Sections 4 and 5 of the Taylor Grazing Act.

Soil and Moisture Conservation

Major effort has been directed toward close coordination of the soil and moisture conservation activities with grazing management to insure sound use and successful rehabilitation of the resources of depleted range areas.

Range reseeding and water control structures, such as detention dams, diversions, dikes, and waterspreading systems designed to stop erosion, conserve moisture, and restore the productivity of the lands, continue to be the prominent conservation practices applied. Practices that have proven successful and are being more widely used in many areas include the use of brush cutters and chemical spraying by aerial methods for removal of sagebrush, and the use of chain drag and cables for eradication of pinon and juniper.

Of particular significance has been the progress made in reseeding depleted range lands. In excess of 100,000 acres have been reseeded during the fiscal year. In the past decade about 1,000,000 acres have been successfully reseeded under the soil and moisture and related conservation programs of the Bureau. Of the various practices carried out by the Bureau, range reseeding has been especially important in the improvement and rehabilitation of depleted range lands.

A series of cooperative studies on conservation problems is being continued with colleges and Federal research agencies. These include studies on the effects of conservation measures on vegetation.

ver, water yields, and sediment deposition. A number of tests conducted by the Bureau of Reclamation on outlet pipe installation in earthfill dams provided information on how to improve methods and standards of construction in these types of installations.

Weed Control

Major efforts have been made to minimize livestock poisoning on approximately 11 million acres of rangeland infested with halogeton, of which about 8 million acres are BLM-administered lands. The halogeton infestation is located in eight of the Western States, the plant being most prevalent in the tri-State area of northeastern Nevada, northwestern Utah, and southern Idaho. Favorable climatic conditions have been responsible for an abundance of weed growth, not only of halogeton, but loco weed and larkspur, resulting in deaths among cattle and sheep.

Permanent control of range weeds comes through improvement of the deteriorated vegetal cover. Therefore, the Bureau's program has consisted mainly of practices which increase the amount and quality of range vegetation.

Annual weed host plants of the sugar beet leafhopper are abundant on some Federal rangelands in southern Idaho, where the leafhopper inflicting severe damage to adjacent agricultural crops as a carrier of the curlytop virus. A control reseeding program, in cooperation with the range users, has been inaugurated to replace the host weeds with perennial grass where feasible.

Cooperative research has been conducted with several of the Western State agricultural experiment stations and the Agricultural Research Service to discover better means of controlling range weeds. The research includes development of selective herbicides, better reseeding methods, and determination of the intensity of grazing use compatible with the permanent suppression of weeds. Of particular significance is a newly inaugurated project to devise some effective means of artificially revegetating the salt desert shrub ranges on which a bulk of the halogeton is located.

Range Fire Situation

The 1957 fire season was one of the worst in recent years on public domain lands. Approximately 5,100,000 acres were burned. Of this total, 1,941 fires destroyed over 320,000 acres of our natural resources in the continental United States.

Loss of forage during the first grazing season from one fire near Shoshone, Idaho, is estimated to be 2,800 animal unit months. In addition to the severe wind erosion which followed, and the ever-

present threat of invasion by the poisonous weed halogeton which is present in the area. In the light of this experience, steps have been taken to strengthen our fire protection system and to increase the efficiency of our fire organization.

In cooperation with the Forest Service, United States Department of Agriculture, and the United States Weather Bureau, fire weather stations are being installed to provide necessary data for use with the fire danger rating system. This system is designed to provide the personnel with advance warning of high fire danger periods and of fire hazard areas. With this information, auxiliary lookout towers may be manned, fire suppression forces strengthened, and additional equipment readied in advance of an approaching fire storm.

As conditions permit, the use of chemical fire retardants, such as sodium calcium borate, are being perfected for use by ground crew and aerial attack crews. Airplanes have also been used with great success in tracking lightning storms, detecting fires while they are still small, and in fire suppression activities on going fires.

Greater efficiency is being attained through expansion of a frequency radio system, permitting greatly improved communication between control points and in remote high hazard areas.

FORESTRY

Forest management is an important part of the Bureau's land managing program. A large percentage of the public domain in the United States contains forest resources. The Bureau also has exclusive jurisdiction over extensive forest lands in western Oregon known as the Oregon and California Railroad Grant lands and the Bay Wagon Road lands. In addition, vast areas of forest and woodland in Alaska are a Bureau responsibility. Each of these three general areas is managed under its own specific plan, suited to meet the overall comprehensive program for the administration of the public lands.

Nature and Scope of the Forestry Program

All of these forested areas are estimated to contain 245 billion board feet of timber on the commercial forest lands alone, with another 210 billion board feet standing on the less productive, non-commercial lands. Although no accurate inventory has been made of a large portion of this area, Bureau foresters estimate that the productive capacity of these forests and woodlands approximates three billion one-half billion board feet per year. The drain of forest products from this great reservoir was 915 million board feet in fiscal year 1964.

Forests are one of the prime assets of the Nation. They produce a material for hundreds of different uses, and when properly managed this production can be sustained in perpetuity. As an example, the O. & C. lands are known to produce enough wood to build 70,000 five-room houses at a never ending, sustained, minimum expense.

Wood or timber is not the sole product because a comprehensive forestry program provides for grazing, wildlife habitat, water conservation, watershed protection, hunting, fishing, and general recreation.

Harvesting mature timber at the proper time and at a rate as nearly equal to the annual forest growth as possible is essential to the Bureau's forestry activities. Timber is normally harvested by companies or individuals who purchase cutting rights through competitive bidding. The value of timber sold from Bureau forest lands last year was \$24,657,212 and the volume disposed of was 915 million board feet. This is an increase of \$3,185,607 and 134 million board feet from the previous fiscal year.

Timber from the Oregon & California and Coos Bay Wagon Road National Forest lands accounted for 760,737,000 board feet of the total sold and \$19,611,568 of the total value. Public domain timber sales and other types of disposal accounted for the remainder. Alaska's vast timber growth coupled with its low demand makes for the major differences between annual growth and harvest on Bureau lands.

During this period the Bureau expended \$5,237,708 for the management and protection of all forest lands.

Access Roads

In addition the Bureau spent about \$6 million on the construction and acquisition of timber access roads on O. & C. lands in western Oregon during the past fiscal year. These roads are designed to tap the tremendous volume of timber in inaccessible areas, provide for year round employment, and aid economic stability in forest communities.

To date \$26,441,000 have been appropriated for construction or acquisition of O. & C. access roads. A total of 222 miles of mainline roads and 36 bridges have been built or are under construction which is an increase of 57 miles and 24 bridges during the past fiscal year. Plans are still being made for the total program of access road construction which is expected to exceed 1,000 miles.

The purchase of rights-of-way by appropriated money for access to public domain timber lands was accomplished for the first time during the past fiscal year. This is a significant advance in the rapidly expanding public domain sales program.



In 1957 and 1958 the Bureau of Land Management was plagued with the worst fire season in its history. Shown is a part of a 1,500 acre range and woodland fire in Montana Grazing District No. 6.

Reforestation and Rehabilitation

The results of an ambitious \$1,000,000 O. & C. forest land reforestation and rehabilitation program are impressive. A total of nearly 18,000 acres was planted with more than 9 million seedlings. In addition, approximately 9,000 acres were seeded both by hand and by airplane. Marked advances made in rehabilitation included the scarification of over 7,000 acres and the treatment with herbicides of another 2,000 acres. Some 50,000 snags were felled.

A statistically controlled reforestation inventory of O. & C. lands presented for the first time a verified statement of the reforestation and rehabilitation problems of the O. & C. lands. As a result of the inventory the reforestation backlog is known to be slightly in excess of 67,000 acres, or 3 percent of the total O. & C. area.

Fire Control

The fire season in Alaska during calendar year 1957 was one of the most disastrous in history. More than 400 fires burned in excess of 4,800,000 acres. High temperatures, strong winds, and an unusually long period of little or no rainfall coupled with lightning storms contributed to the severe fire situation.

It is generally agreed that the staggering losses in Alaska would have been substantially greater without the Bureau's recent reorganization. Centralizing fire control activities under the direction of an area staff officer permitted prompt response to rapidly changing circumstances and made for the best possible use of available fire control facilities and manpower.

The largest blaze during the past fiscal year was the Kuskowin fire located on public domain land in southwestern Alaska. It was estimated to have burned in excess of $1\frac{1}{2}$ million acres, or an area the size of Rhode Island, and damaged all types of land and resources. Conservative estimates are that this one fire alone caused damages amounting to at least \$ $1\frac{1}{2}$ million plus wildlife and watershed losses.

As a result of this devastating fire season several new innovations have been placed into effect. One of the outstanding developments was the adoption of the systematic, high speed, airplane fire patrol in the place of all lightning storms to detect fire while still very small. The steady patrol plane in addition to following the wake of the lightning storms is manned by a pilot especially trained in fire detection work. In Alaska it is most important to detect fires at their offset because manpower and facilities are limited and distances which must be traveled are enormous. Every minute saved at the beginning of a fire in starting control action will save large expenditures not to mention the saving of resources.

Another innovation was to make extensive and systematic use of sodium borate with a water mixture which is carried in airplane tanks and dropped on going fires. This proved quite effective on lightning fires of small size pending the arrival of manpower to complete the work. In addition, it has proven effective in preventing critical spots along the margin of large fires from developing into crown fires and going out of control. This technique was being given a comprehensive test at the close of fiscal year 1958. The results of this new technique looked most encouraging.

Construction in Alaska of fire protection facilities at McGrath, Barrow, and Fairbanks was nearly completed during the year. Plans were laid for construction of fire suppression facilities to be completed at an early date at Fort Yukon, Glen Allen, Palmer, Big Lake, Lake Louise, and Fairbanks. The construction at Fairbanks includes facilities for establishing a corps of smokejumpers.

The initiation of the smokejumper program is being treated as a matter of high priority. It offers the best prospect of overcoming one of the general weaknesses of the Bureau's fire control program in Alaska. Even with speedy discovery of small lightning fires, too many of them reach major proportions before control parties can

reach them. The smokejumper program means that when the necessary facilities are constructed, fire fighters and their equipment can be dropped by parachute close to fires and moved into action while these fires are still small and easy to control. Helicopters are now playing a vital role in solving the forest fire problem in Alaska, as well as in the new construction of outlying stations.

In the United States on the lands protected by the Bureau in excess of 320,000 acres were burned during the past fire season. There were 979 fires on Bureau lands. The average cost of protection on areas under fire protection contracts was approximately 15 cents per acre while the protection costs on the areas in which the Bureau does its own protection work amounted to slightly less than 0.6 cent per acre.

In order to standardize procedures and exchange ideas in fire control work, a Bureau-wide fire conference was held. The results of the conference were used in revising the Fire Control Manual.

Control of Forest Insects and Disease

While far less spectacular than fire, annual damage by insects and diseases often exceeds that of fire and the ravages are much more difficult to control. Infestations are hard to detect and do not reach epidemic proportions before adequate control measures can be effected.

During the calendar year 1957, in its Blister Rust Control Program the Bureau destroyed 22,518 ribes on 3,232 acres, of which 707 acres were initially worked and the remaining acreage reworked. Of the total contract area 36,554 acres, or 60 percent is on a maintenance basis. There are 61,204 acres of control area administered by the Bureau. This area is expected to be increased in the near future.

Some initial work was accomplished in developing a rust resistant species of pine. A total of six rust resistant trees were located and marked for future study and observation.

The Public Domain Forest Management Program

Significant progress in advancing sound management of public domain forest lands was made during the past year. By classifying at least some of the public domain as having as its highest priority intensive management of the forest resources, emphasis was given to the fact that timbered public domain lands should be administered for forest production. Access, forest inventory, and reforestation highlighted the Bureau's public domain forestry program.

A major step in advancing the timber sale program on public domain lands was adopting a policy which permits the use of timber

ery rights-of-way for access to certain timber sale areas. This plan will provide a type of access adequate to support current planning and programing for substantial increases in public domain timber sales.

An intensive public domain forest inventory program got into full swing in the States of California, Oregon, Idaho, Utah, Nevada, Arizona, Montana, Colorado, and New Mexico. Even though this inventory study is just getting under way, some of the initial findings are most impressive. A closer relationship between the annual growth or timber production and annual cutting will be the natural result of the survey. On the basis of the inventory an annual timber sale plan was started. The sale plan already shows increases of more than 100 percent over the previous year's sales in some of the public domain States. The annual sales plan will materially aid both the Bureau and timber purchasers in programing and operations on public domain forest lands.

CADASTRAL SURVEYS

Cadastral surveys create, reestablish, and identify the boundaries of the public lands. The Bureau of Land Management is the official agency responsible for the cadastral survey of the public lands of the United States. Land boundaries must be established and known before any comprehensive management program can be initiated on the public lands. Such programs involve the development and conservation of the natural resources.

Most of the public lands in the continental United States are located in the 11 Western States. In those States there are about 100 million acres of public lands which have not yet been covered by the cadastral survey rectangular net. Additionally, there is need for re-survey to rehabilitate and reestablish the corners and lines marking the boundaries of some 50 million acres of the public lands in the Western States.

The program of cadastral surveying of the Bureau of Land Management for fiscal year 1958 was designed specifically to afford the most possible aid in the management of the lands and the development and conservation of their natural resources.

The surveys to establish the boundaries of school sections granted to the States have been of major importance, especially to some of the Western States. Those surveys must be completed and accepted before title to the school sections may be transferred to the States. The increase in value of lands and the widespread development of minerals has created an urgent need for transfer of the school lands to the States. To meet that insistent demand, the Bureau has devoted

a considerable portion of the engineering work program to the execution of school section surveys, particularly in Utah and California.

There has been widespread and great demand for homesites under the small tract law of 1938, which has been reflected in the demand for surveys and resurveys to meet the needs of that management program. This class of work has been particularly extensive in California. Extensive surveys and resurveys were made in that State to fulfill the management requirements in that phase of activity.

The development of the mineral resources of the public lands, particularly the oil and gas leasing activities, have required extensive surveys and resurveys in continental United States. In Alaska oil and gas leasing activity has placed important new responsibilities on the cadastral surveying function. This work has required planning and protraction of the cadastral survey net in advance of actual field surveys to afford a basis for location and record keeping.

During the year, work has been continued in the mapping of the coastline and preparation of leasing maps as the basis for administration of lands on the Outer Continental Shelf. Those maps serve as the basis for leasing for development of the oil and gas resources. Pending resolution of the boundary question before the Supreme Court of the United States the preparation of leasing maps has proceeded in order that the Bureau may be in position to lease these areas when the boundary questions are settled.

In order to improve operations and effect economies, the Bureau has been conducting experiments in improved methods of transportation, measurements, and surveying.

The use of helicopters in the transportation of survey parties in extremely rugged areas has been thoroughly tested and proven. The use of that equipment has speeded up the execution of the surveys in southeastern Utah with considerable reduction in the cost per survey unit. That method of transportation will continue to be used in the work in southeastern Utah and extended to other areas where practicable.

The Bureau has initiated a project to test the application of photogrammetry on original surveys in ten townships in Utah in areas that can be reached by helicopter. This project will involve testing of photogrammetry, of surveys executed by normal ground methods in five townships, and the establishment of the corners and lines by exclusive photogrammetric process in adjoining five townships.

An electronic distance-measuring device has been placed under experimental use. Tests to date indicate that this type of equipment has a definite place in the cadastral survey and resurvey of the public lands for the determination of distances where measurement by conventional methods would be slow and costly.

Surveys in Continental United States

Cadastral survey projects completed in the continental United States during fiscal year 1958 embraced the survey and resurvey of 77,816 acres of public land. Those surveys included the identification of the boundaries of 109,440 acres granted to the States for the benefit of their schools; the survey and resurvey of mineral lands as a basis for the development of those resources, principally oil and gas; the resurvey of forested areas to define the boundaries of timber management units for the settlement of trespass cases and to provide a basis for timber sales; the survey of grazing lands; and the survey of small tracts to provide homesites and business sites.

Alaska Surveys

The cadastral survey program in Alaska was designed to meet the needs for the management of the public lands; the development and conservation of the natural resources; and to accommodate the expanding economy of that Territory and the increasing population. During the fiscal year 1958 the more urgent cadastral projects in Alaska were undertaken and completed. That program included the survey and resurvey of 45,782 acres of land under the rectangular system of surveys.

OUTER CONTINENTAL SHELF

The Outer Continental Shelf Office at New Orleans is administered by the Eastern States Office of the Bureau of Land Management to handle leasing for oil and gas and sulphur and applications for pipeline rights-of-way. The office also furnishes public information, including leasing maps, to all interested applicants and the public. This office acts as liaison with the oil and sulphur industry in leasing activities and, under delegated authority, handles assignments, relinquishments, and other actions on 412 active leases covering 1,586,709 acres as of June 30, 1958. From these leases \$3,460,851 was collected during the past year in lease rentals and royalties.

EASTERN STATES

The Eastern States Office, in carrying out its 1958 program in the public domain States of Alabama, Arkansas, Florida, Louisiana, and Mississippi, under the field office at Russellville, Ark., and in Michigan, Minnesota, and Wisconsin, under the field office at Bemidji, Minn., transferred title on 61,836 acres of public lands to non-federal owners.

ship. Included in the above figure were 9,922 acres of State Select and Exchanges; 298 acres under the Recreation Act and 5,690 acres to individuals under Color-of-Title Act. Receipts from sales amounted to \$543,903.

Leases on both public lands in the above States and on acquired lands in the 18 non-public-land States, where the Eastern States Office has responsibility for subsurface resources, accounted for \$7,020,000 from oil and gas and other leases. All mineral work in these States, both hard rock and leasing, including mineral appraisal and examination, is handled by the Eastern States Office.

A thorough review of all tract books, including reference to Land Office records in the National Archives, was started in 1958 to determine old withdrawals that may be subject to revocation and old entries never closed that could be listed as vacant.

Color-of-title claims to public lands in the south, particularly in Louisiana, Alabama, and Mississippi, have presented a difficult and time-consuming problem, as each tract requires considerable detail and personalized contact with county records and individuals concerned. However, this past year 117 color-of-title claims were cleared and 28 tracts cleared for patent.

APPEALS

The appeals office was established in April 1955, as a special unit to handle cases on appeal to the Director more effectively and efficiently.

An important change in the rules of practice was adopted in May 1958, permitting greater liberality in the consideration of appeals. Formerly an appeal or its supporting documents could not be considered unless actually received in the proper office within the prescribed period. This caused considerable hardship in certain instances where a document had been mailed on time but did not arrive in the appropriate office until after the prescribed period. The rules were changed to provide that a document may be considered on time if transmitted within the required time, provided it is received in the proper office within a 10-day grace period.

The productive efficiency of the appeals office continued to increase during the past year, and 1,011 decisions, involving a total of 1,011 appeals, were rendered during the past fiscal year. Nevertheless, a substantial increase to 2,535, in the number of appeals received caused the appeals backlog to increase accordingly. This increase reflected the growing activities in Bureau field offices. Several improvements and techniques have been adopted to cut down this backlog.

apt and efficient handling of appeals actions and eventual elimination of the appeals backlog will substantially improve the Bureau's relations and its services to the public.

Other duties of the appeals staff include the maintenance of appropriate legal and reference data and the distribution of such information throughout the Bureau. One of the major activities in this is the preparation and distribution of the digest-index within the Bureau, and to other Government agencies whose work is affected by the decisions of the Bureau. During the past year this digest-index was expanded to include 27 grazing topics and lesser changes in other fields.

INTERNATIONAL COOPERATION

The facilities and experienced technicians of the Bureau of Land Management continue to be utilized as requested by the International Cooperation Administration and other agencies in support of foreign programs. This activity takes many forms including opportunities for officials of developing countries to observe United States policies and methods which have proven successful in extensive public land management, development and management.

There is a constant exchange of ideas between Bureau of Land Management officials and officials of other countries on basic cadastral engineering survey systems and techniques, installation, and maintenance of public land records, land use classification, land, mineral, logging, forest and other resource disposal and leasing policies and practices, organization, operating methods, and programing.

Over 40 officials from other countries were with the Bureau during the year, most of whom visited the field offices. All requests were met for overseas assignment of Bureau technicians without undue interference with domestic responsibilities. Relationships with agencies of other Governments performing functions similar to those of the Bureau of Land Management were expanded. Considerable fieldwork was laid for increased participation of the Bureau's technical and operating experience in activities of international organizations.

STAFF SERVICES

A wide variety of special services and functions are performed by the Division of Staff Services, under the supervision of the Associate Director. The three principal offices which make up the Division are the Office of Hearings Administration, the Management Improvement Office, and the Program Coordination Office.

Office of Hearings Administration

During the year there was increased activity concerning the type of proceedings coming before the Bureau in which formal hearings are required by laws or regulations of the Department.

A total of 330 cases were referred to Bureau Hearings Examiners during the year. Of these, 86 were appeals and enforcement proceedings arising under the Federal Range Code. Most of the remaining 244 cases were proceedings to determine the validity of mining claims and other types of land entries. These involved a total of 712 claims and entries.

Examiners conducted hearings in 211 cases during the year and closed 343 cases on their dockets, including 117 grazing cases and 226 lands and minerals cases involving 752 claims and entries. Examiner decisions on the merits following hearing, were rendered in 203 of the closed cases. The remainder were closed without hearing, through dismissal or on other procedural grounds. At the end of the year, examiners had 264 unclosed cases, including 111 grazing cases and 153 lands and minerals cases.

The act of July 23, 1955 (Public Law 167) includes procedures for determining the Government's right to use the surface of lands in patented mining claims located prior to July 23, 1955, and to manage and dispose of the vegetative resources of such lands. During the year, the first proceedings under Public Law 167 reached the hearing stage and involved 106 mining claims.

Office of Management Improvement

To furnish specific stimulus for improvement, the Bureau has a Management Improvement Office. This office encourages, directs and coordinates the improvement efforts of the headquarters and field offices. Its staff also performs management surveys, spearheads the Incentive Awards Program which recognizes outstanding employees and their suggestions, and conducts general organization research and planning. Finally, the office serves as a clearing house and contact point for regulations, procedures, records, forms and manuals and instructions.

Employee suggestions for improvements continued to increase during the year. This was due largely to a decentralization of the Incentive Awards Program, which permitted area committees to act upon certain types of suggestions. Suggestions received increased 54 percent over the previous year, with a corresponding increase in awards. For the same period, cash awards for superior performance increased 135 percent. The Secretary granted four Unit Awards to Bureau

es for meritorious services, involving substantial monetary recognition to 21 employees. And finally, a Bureau candidate received Department Conservation Award.

ome 500 Bureau forms were brought under full control for the first in recent Bureau history. A system is now operating to eliminate old used forms and combine others, to simplify their language and make them easier to use, and to establish new forms and control procedures as quickly as they are needed. Most forms are gradually being changed from legal to letter size to conserve file space. Several field offices also began control programs for locally produced forms.

To direct attention to special situations where management improvement is needed, Bureau offices schedule improvement projects. These projects focus manpower and money on potential or actual management problems and their solution. Projects are scheduled yearly, reported on periodically and reevaluated from time to time. The number of projects scheduled and completed has steadily grown.

Special management surveys were made in the Anchorage, Alaska, Field Office and in the headquarters appeals office. The Anchorage surveys were comprehensive and have resulted in extensive changes throughout all phases of the office activity. The appeals office survey led to better file control, more comprehensive standards for preparing decisions and improved work allocation among employees.

Program Coordination Office

Public lands and natural resources administered by the Bureau of Land Management belong to all of the people. It is important and necessary, therefore, that State, regional, and national considerations be built into the policies from which operating programs are developed. These programs are drawn up by the people in the Bureau who are responsible for carrying out realistic programs in an economical and practical manner.

The Bureau's program system provides the basic mechanism for documenting these operational plans in the field and for pulling them together for review, consolidation, and translation into an integrated Bureau program at each level of operations. The results expressed in this balanced program for the Bureau are the basis from which necessary funds for operations are requested.

Program proposals are communicated in terms of the work to be done and the personnel, materials, and other costs necessary to meet program goals. Also included in these evaluations of work proposals are contributions in the form of labor, material, or money made by

users of the public lands for improving, developing, or protecting public lands and resources.

The first concrete results of this process appear in the appropriation of funds by Congress which permits the Bureau to act on these plans. Once this process has begun, annual work plans are put in final form. Regular operations continue and new work is started. Annual work plans receive the same type of review, consolidation, and transition into Bureau totals as do the program proposals on which the plans were based.

Beginning this fiscal year, a technique for periodically reporting progress on the annual work plans was put into use throughout the Bureau. It has provided managers at all levels with a comprehensive periodic statement of what has been done. These reports, which show work scheduled, work accomplished and money spent, help point out the operational areas that need special and immediate attention in order to prevent disruptions which could arise and cause imbalance on programs of subsequent periods.

With the adoption of progress reporting, a companion project to simplify all reports and reporting procedures has been started. The principal objective of this project is economy in reports by eliminating duplication and requiring the submission of only essential data that are pertinent and usable by management in measuring and evaluating the results of the Bureau's operations.

RECORDS IMPROVEMENT PROJECT

The Records Improvement Project is responsible for devising, preparing, and installing new land status records for the original public domain States and Alaska. A revision of the public land records is necessary to preserve information which otherwise would have been lost through deterioration of the present records, and to provide for the recording of multiple uses of and interests in public lands which have been made possible by legislation of recent years.

During the past year, new status records were installed in Utah. Contracts were awarded for preparation of status records for New Mexico and Oklahoma, and preliminary studies for an Arizona contract were completed.

PERSONNEL MANAGEMENT

Training and Safety

In order to accomplish the highest degree of efficiency, a total of approximately 180 formal training sessions were conducted at the

and State offices, as well as district and land offices. Courses were held on general orientation, improvement of reports, administrative procedures as they apply to lands and minerals activity and land management. There were record management conferences, forest and range appraisals, O. & C. forest policy, and progress conferences. These are only representative of the training sessions which ranged from 2 hours to 5 days, as well as on-the-job training, throughout the year. One hundred twenty-two employees participated in correspondence workshops held in the Washington office. These training sessions were designed to improve letter writing skills. The intensity of the safety program this year resulted in improvement of accident reporting. The motor vehicle operator licensing program was broadened to include road testing for all industrial operators and testing must be completed by March 15, 1959. Studies were made of accident causes and methods to be used in eliminating causes of accidents. Safety committees were formed in Area and State offices.

Outfitting

Bureau personnel visited colleges and interviewed students, dealing with them career opportunities in the Bureau. Special emphasis was placed in the engineering, range, and forestry fields.

The revised Bureau Promotion Plan was put into complete operation on January 1, 1958.

Employment in the Bureau as of June 30, 1958, totaled 2,938, distributed as follows: Area 1, 837; Area 2, 766; Area 3, 733; Area 4, 55; Eastern States Office, 40; and Director's Office, 305.

FINANCE

Gross receipts from the sale and management of public lands and resources during fiscal year 1958 totaled \$127,385,000. These receipts came from the following sources: Mineral leases and permits \$95,369,102, including \$3,460,851 from rents and royalties on Outer Continental Shelf; timber sales \$24,657,212; sales of public lands \$3,035,139; grazing leases, licenses and permits \$2,763,320; fees and commissions \$1,184,382; rights-of-way \$105,257; and \$269,688 from all other sources.

Bureau of Land Management receipts for fiscal year 1958 were distributed as follows: \$46,605,380 to 26 public land States and Alaska, of which \$11,635,514 went to the 18 western Oregon timber counties; \$47,088,978 was deposited to the Reclamation Fund; \$24,255,662 went into the General Fund of the Treasury; \$3,262,029

was transferred to other Government agencies; \$315,965 was marked for Indian Trust funds; and approximately \$686,713 was turned to the grazing districts for range improvements.

Total appropriations for Bureau of Land Management operations during fiscal year 1958 amounted to \$22,700,000; for construction \$5,480,000; and \$564,846 for range improvements.

NATIONAL PARK SERVICE

Conrad L. Wirth, *Director*



THE YEAR 1958 for the National Park Service and the National Park System was marked by an unusual record of progress and accomplishment. In its second year, Mission 66 remained essentially on schedule, and with new and improved facilities and services coming rapidly into evidence, public approval and acclaim of this dynamic conservation and development program rose to new heights. At least a part of this widespread approval was due to the emerging realization on the part of the American people that, despite the large-scale development of new and improved visitor facilities, the Mission 66 program actually is applying even more emphasis to the preservation undisturbed of the great wilderness areas of the national parks and monuments. As work on Mission 66 projects advanced it became more clearly evident to proponents of park conservation that the vast wilderness areas—as well as the sense of undisturbed wilderness—essential to the full enjoyment of even the most visited parts of a national park—were being treated as a priceless resource to be zealously safeguarded and preserved.

During the 12-month period a total of \$65,701,300 was expended or obligated for some 736 construction projects, including new and improved campsites and visitor centers. At the same time private capital invested more than \$5,500,000 in the construction of public accommodations and related service facilities, increasing overnight capacities by approximately 1,800.

One of the most dramatic examples of the economy, efficiency, and adequacy of the Mission 66 approach to meeting the expanding needs of park improvement was provided by the Canyon Village development in Yellowstone National Park. There a new lodge, cabins, playgrounds, trailer court, visitor center and museum, store, service station, and other facilities were completed and in use at the end of the fiscal year. Completion of that project not only made overnight

accommodations available for nearly 4,000 visitors but also will make it possible to raze the old lodges and cabins from the rim of the Grand Canyon of the Yellowstone and begin the esthetically vital work of restoration and preservation there.

Similar projects—also designed to meet the needs of the ever increasing numbers of park visitors—were completed at Colter in Grand Teton National Park, in the Mather area of Grand Canyon National Park, and at Flamingo in Everglades National Park.

Other highlights of Mission 66 accomplishments during the fiscal year included completion of the Dinosaur Visitor Center; the completed development of Jamestown Island, Colonial Parkway, and Yorktown for full use during the year-long celebration of the 300th anniversary of the landing of the Jamestown colonists; completion of Stevens Canyon road in Mount Rainier, the East Side road in Grand Teton, and the Park Road in Everglades National Park; and launching of the Ranger III, passenger boat to serve Isle Royale National Park.

In the last 3 months of the fiscal year added impetus was given to the program when contracting for new work was speeded up as part of the Administration's anti-recession program. During that period contracts amounting to almost \$34 million were let for work on roads, parkways, buildings, and other facilities.

One of the essential elements in the carrying forward of the work of Mission 66 is a broad and comprehensive legislative program. Under guidance of the Administration and the Department throughout fiscal year 1958, coordination and direction were provided by the National Park Service for such a program with notable results in the form of congressional action. For example, after many years an acceptable boundary was fixed for Everglades National Park. Change of authority was obtained through which private lands in Olympic National Park may be acquired. The establishment of Clatsop National Memorial was authorized to commemorate the successful crossing of the continent by the Lewis and Clark Expedition and National Park status was made possible for Petrified Forest National Monument.

Meanwhile other legislation pending in Congress at the end of the fiscal year would authorize establishment of national parks on Cape Cod, Mass., and Padre Island, Tex.; preservation of an undeveloped stretch of the Indiana Dunes on the shore of Lake Michigan as a national monument; transfer of Grant's Tomb in New York City to Federal ownership as a national memorial; and creation of a Gateway Portage National Monument in Minnesota.

Surveys of Pacific Coast and Great Lakes Shoreline

During the fiscal year marked progress was made on the shoreline surveys financed by donated funds. The master report for the Pacific Coast Seashore Survey was completed, with summary analysis of 75 areas. Separate reports were prepared for 7 coastal areas of major importance of which 3 have been given favorable consideration for national status by the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments.

Field work for the recreation resource survey of the Great Lakes shoreline was largely completed, and the final report is scheduled to go to press by December 31. Reports have been prepared on 48 areas.

National Survey of Outdoor Recreation Resources

Work was initiated on a national inventory of existing parks and recreation areas and their facilities and of potential areas suitable for administration at various levels of government. The results of this inventory will be made available to the National Outdoor Recreation Resources Review Commission, established by congressional act on June 1958.

Historic Surveys Resumed

Two historical survey programs, begun in the 1930's but suspended since the beginning of World War II, were resumed during the fiscal year. One is the National Survey of Historic Sites and Buildings. In this program the history of this country has been divided into a total of 21 themes, each theme covering a specific segment of history and pre-history on the continent. Work was started during the fiscal year on preparation of reports on historic sites and buildings of five of these periods of history. The second survey program resumed was the Historic American Building Survey. Through the student assistance program measured drawings were completed for many historic buildings not previously included in the survey. Drawings were finished on partially completed surveys remaining after suspension of the work in 1941.

Park Attendance

The upward curve in park attendance continued, though the rate of increase receded somewhat below the past 10-year cycle. In the calendar year 1957 there were 59,285,000 visitors, an increase of 7.9 percent over the 54,923,000 total recorded in 1956.



CAMPFIRE TALK.—Scenes of the National Parks and explanations of the scientific and historic wonders are unfolded by a National Park ranger at an illustrated campfire talk in Badlands National Monument. Mission 66 enabled the Park Service to recruit more rangers and to expand its interpretive service to park visitors. *National Park Service Photo.*

Land Acquisition

During fiscal year 1958 a total of \$1,889,650 was made available for land acquisition, including \$400,500 from donations. Some 25,000 acres of inholdings were acquired by purchase, donation, and exchange in addition to 26 areas of the National Park System. Transfer of Federal lands added 256.19 acres to two areas.

Donations of lands included 367 acres from the Territory of Hawaii for Hawaii National Park; 2,261 acres from the State of North Carolina for Blue Ridge Parkway; 1,540 acres from the State of Tennessee and 63 acres from the State of Mississippi for Natchez Trace Parkway; 7.5 acres from the State of South Dakota for Mount Rushmore National Memorial; and 5.6 acres from the City of Richmond for Richmond National Battlefield Park. Other donations of lands by individuals added significant acreages to Acadia National Park, Blue Ridge Parkway, Colonial National Historical Park, Death Valley and Effigy Mounds National Monuments, Fort Caroline National Memorial, and Theodore Roosevelt National Memorial Park.

Approximately 160 options were approved for acquisition of about 6,580 acres of land and interests in lands in 20 areas. Ten options, to

ing \$222,675 and covering 853.91 acres of land in six areas of the National Park System were processed for use with 1959 fiscal year land acquisition funds.

Concession Authorizations

Seven concession contracts were negotiated during the year. These included for construction programs at Mount McKinley and Grand Teton National Parks, and Blue Ridge Parkway, representing investments of about \$645,600.

Training Center

Both staff increases as Mission 66 progresses, and earlier retirements because of liberalized retirement legislation, have made it vitally necessary that new park rangers, historians, naturalists, and archeologists become soundly grounded early in their careers in Park Service history, policies, and practices. This requirement was recognized by the Congress in fiscal year 1957 when it approved the establishment of a training center for career-conditional uniformed employees at Yosemite National Park on a 3-year trial basis. During the past year this new institution conducted its first two intensive 3-month training courses. The first course enrolled 25 trainees, who received basic information and specialized training in protection, interpretation, and visitor services, and as a result were considerably better qualified for their duties.

Special Observances

The outstanding celebration of the year was the Jamestown, Williamsburg, Yorktown celebration commemorating the 350th anniversary of the founding of the first permanent English settlement in the New World at Jamestown in 1607, the flowering of Virginia culture and statesmanship at Williamsburg on the eve of and during the American Revolution, and the final winning of American independence at Yorktown, Va., in 1781. The celebration was marked by the opening of new National Park Service visitor centers and museums at Jamestown and Yorktown, by the visit of Queen Elizabeth II and many other distinguished visitors to Jamestown and Williamsburg, and by the reenactment of the siege of Yorktown and the surrender of Cornwallis at Yorktown on October 19. The State of Virginia cooperated in building replicas of the three ships that brought the first colonists to Jamestown and by reconstructing a full-scale likeness of James Oglethorpe at Glasshouse Point. The Jamestown Glasshouse Foundation, representing the American glassworkers and glass industry, re-

constructed and operated the Jamestown Glasshouse of 1608, one of the high points of interest of the entire celebration.

Secretary Fred A. Seaton was the principal speaker at the 34th annual establishment day celebration June 1 in Craters of the Moon National Monument, Idaho. Dedication of the new visitor center was a significant part of that celebration.

Assistant Secretary Roger C. Ernst was the principal speaker at the dedication June 1 of the new visitor center in Dinosaur National Monument, Utah and Colorado.

Mountain Climbing

For the third successive year the peak of Mount McKinley, Mount McKinley National Park, Alaska, remained unclimbed. Unlike previous years, Nature imposed a new obstacle which consisted of spectacular movement of the Muldrow Glacier during the winter 1956-57. This tremendous ice movement resulted in several large ice waves moving downward, erecting great seracs and an impassable barrier to climbers using the conventional route. A party of eight climbers turned back after spending 17 days on their attempted climb. Highest elevation reached was 8,500 feet, considerably less than half of the peak altitude of 20,320 feet.

Vandalism

One of the historic structures in the Death Valley area was destroyed during the year when vandals removed the evaporating pans and stack of the Eagle Borax Works. This was the first commercial effort to produce borax in Death Valley and the works was constructed in 1881 by Isadore Daumet. The vats were hauled nearly 8 miles across the desert, by wagons, from Los Angeles. Although the venture was not successful financially and closed down 1 year later, it represented the spirit and physical effort that the early pioneers exerted to develop the mining industry.

Launching of Ranger III

Ranger III, the new 100-passenger motor vessel that will provide passenger-cargo service to Isle Royale National Park, Mich., from Houghton, Mich., was christened and launched in special ceremony at Sturgeon Bay, Wis., on June 21, 1958. The celebration was sponsored by the firm that constructed the boat under a \$1,159,600 National Park Service contract.

Ranger III was scheduled to be placed in operation in fiscal year 1959, at which time the scenic beauty of Isle Royale National Park

will become more accessible to greater numbers of visitors. Transportation to the park in past seasons has been limited to a 16-passenger boat operated by the Park Service out of Houghton, Mich., and to privately owned vessels out of Grand Portage, Minn., and Copper Harbor, Mich. Service from the latter two points will continue. The new boat will make the 75-mile trip from the Michigan mainland to the park in approximately 5 hours as compared with the 7 hours required in the past.

Construction of the new vessel is one of a number of projects for development of the park under the Mission 66 program. Isle Royale National Park, containing more than 800 square miles of land and water, consists of some 200 islands in Lake Superior. Isle Royale, the largest, contains about 210 square miles.

PROGRESS ON MISSION 66

It has now become impossible to separate Mission 66 from the overall National Park program. During the planning stage Mission 66 had an identity of its own. Today it is so integrated with the overall Service program that the words Mission 66 simply mean a total National Park program, full-scope, fast-moving, and conducted on a larger scale than ever before.

Thus all elements of the original Mission 66 plan, described in detail elsewhere in this report, demonstrated renewed and expanded activity. Numerous legislative matters in support of individual area Mission 66 programs were submitted to Congress.

With all prospectuses completed and approved, except for a few special cases, Mission 66 staff work in support of the overall program focused upon special problems and upon the improvement of the efficiency of the internal operations of the Service. Special studies of Yosemite Valley, Mesa Verde National Park, and National Capital Parks, were undertaken leading toward the solution of complex protection, use, and development problems. Studies were well advanced toward the development of an improved organizational structure for the Service, and in the clarification and strengthening of the instruments for planning and administrative control.

New positions in the field service were filled, resulting in an immediate improvement of public services, a stronger defense and attack against forest fire, forest pests, and other destructive agents, and more adequate maintenance of park facilities.

In an attempt to attract a higher quality of new recruits in the increasingly competitive field of park planning, park administration, protection, and interpretation, booklets describing the employment opportunities in the National Park System were prepared and will be issued in time for next year's recruitment season.

In the field of public information, in addition to numerous press releases and the release of the fourth of a series of tape-recorded illustrated programs on Mission 66, the Staff prepared and released leaflet Mission 66 in Action reporting the first year of progress, and an illustrated brochure entitled The National Park Wilderness. Both publications were published through the generosity of the Jack Hole Preserve, Inc. The latter publication defines the protection and preservation responsibilities of the Service, reviews the record of the past, and points out how these responsibilities will continue to be met in the future under the Mission 66 program. This publication is regarded by the Service as a very important interpretation of wilderness preservation policy for the guidance of the Service, as well as for information of the general public.

INTERPRETATION

The National Park Service, through its various interpretive programs, makes a substantial contribution to the conservation movement in America. Through interpretation, park visitors gain understanding of nature's workings and of our country's history. Knowledge of nature and the past promotes thoughtful consideration of the present and the future. Through this understanding and consideration, the cause of conservation is served.

It is seldom realized what a potent force the parks and monuments are in the teaching of conservation. The millions who participate in the interpretive programs learn the lessons of conservation in the most possible setting. Fortunately, through Mission 66, the interpretive programs are developing rapidly to meet the ever-increasing demand for such services in the areas of the National Park System.

Services to Public

The steady increase in the number of visitors receiving interpretive services was continued during the year. In every category of interpretive services the number of park visitors served was greater than in previous years. In the calendar year 1957 the number of visitors who participated in trips conducted by naturalists and historians rose to 2,404,474. Nearly seven and a half million persons heard talks given by Park Service personnel and more than 25,000,000 were assisted by various forms of self-guiding devices. While all of these figures represented substantial visitor participation increases throughout the park areas, the greatest increase occurred in the number of talks given and attendance at the talks in historical-archeological areas.

Visitor Centers

A vital element of the park interpretive programs is the visitor center. It represents the hub of interpretive and informational services for that part of the park where it is located. In the visitor center park visitor learns what to do and what to see. Exhibits explain features or events that make the park of national significance.

During the fiscal year a total of eight new visitor centers were completed and opened to the public; 18 others were in various stages of construction, and plans were in preparation for still others.

Using a variety of media, each visitor center is designed to tell those parts of the park story which can best be treated at a central location. Colorful panels, models, specimens, dioramas, and audio-visual devices are skillfully employed to tell the story in an accurate and interesting manner.

A unique exhibit is found in the newly completed visitor center at Dinosaur National Monument. The story told here is about dinosaurs and their world, but visitors are also interested in watching men at work in the fossil quarry. Consequently, almost every day a paleontologist and his crew may be found at work there. At no other place in the world can a park visitor have the thrilling experience of watching men uncover the fossil bones of long extinct animals.

Roadside and Trailside Interpretation

The introduction given the visitor to the park areas by the new visitor centers was supplemented in 1958 by a new approach to the development of more effective roadside and trailside interpretive facilities.

Teams were established to work together in planning the roadside and trailside exhibits and signs so that these devices would be carefully coordinated with other interpretive facilities of the parks. These teams included a park interpreter, a landscape architect, and a representative of the Museums Exhibit Planning Teams.

Results of their work can be seen in the roadside interpretative exhibits completed, typical of which were those for the Flamingo Road, Everglades National Park, and in the Richmond National Battlefield Park. Work was well advanced on a number of other similar projects.

Audio-Visual Planning and Installation

Significant further progress was made during the year in the use of audio-visual equipment to supplement personal interpretive serv-

ices for visitors in the parks. With the assistance of the Audio-Visual Committee, the Chief Naturalist gave special attention to a program for coordination of audio-visual planning and installation with building projects. Emphasis also was placed on acquainting equipment manufacturers with Park Service interpretive programs, on the accomplishment of major installations by contract. Significant among contract installations were the fully automatic slide projectors with synchronized sound installed in the two new visitor centers at Colonial National Historical Park.

Museum Program

The Western Museum Laboratory, which had been closed at the approach of World War II, was reestablished in San Francisco in the old United States Mint Building. Like the Eastern Museum Laboratory in Washington, it builds exhibits for the new facilities being constructed under Mission 66. Its first assignment was the preparation of exhibits for the Quarry Visitor Center, Dinosaur National Monument.

NEW JAMESTOWN VISITOR CENTER.—This new structure on the grounds of historic Jamestown Island was completed under the Mission 66 program in time for the 1957 celebration of the 350th anniversary of the first permanent English colony's founding in America. Hundreds of thousands of visitors came to the new center for information during the year.



At the same time, during the year, the Eastern Museum Laboratory completed new exhibits for a total of 10 park areas, and construction was under way on exhibits for 14 additional areas.

In addition, the Museum Planning Teams attached to the Eastern and Western Laboratories assisted park areas with museum planning programs and with preservation of their collections.

Of significance during the year was a revision of the National Park Service museum records system, designed to preserve more efficiently the scientific and historical collections in its care. As a part of the new program, each region appointed a museum curator to assist park staffs in bringing records up to date and work on the revising and updating of records was gotten under way in more than three-fourths of the parks. A Museum Records Handbook was issued, and hundreds of valuable museum specimens were added to accountability records. At the same time, considerable progress was made in bringing accession records up to date. At the close of the fiscal year, the detailed cataloging of individual specimens was in progress in many park areas.

Research

The research program was widened and accelerated during the fiscal year, with a number of significant and tangible results. A project was inaugurated at Harpers Ferry National Monument to collect and correlate all available data on the appearance and history of the town, the armory, and the arsenal. Archeological and historical investigations begun in 1957 at Fort McHenry National Monument continued through 1958. Archeological and historical salvage operations continued in many of the major reservoir areas throughout the United States. A new archeological salvage program was inaugurated in the Upper Colorado River Basin where many heretofore unknown archeological sites were found in the Glen Canyon Reservoir and Navajo Indian Reservoir areas.

Important progress was made in the restoration of Independence Hall, with the removal of much paint from interior and exterior woodwork and the repair of exposed areas. In this connection, architectural investigation of the Tower Room produced valuable knowledge about the original carvings of the 1750's.

In natural history, a broad spectrum of studies was carried on. A research conference in Everglades outlined needed studies and several were gotten under way. Continuous studies of Blue Glacier in Olympic were effected. Detailed studies were made of Yellowstone thermal areas and Mammoth Cave siltation. A program of Alpine wilderness research was initiated, as was a similar project of research on the biology of the United States Virgin Islands.

Wildlife

A significant advance in the conduct of basic wildlife research the National Park System was made during the fiscal year. The Division of Interpretation was given specific responsibilities in developing the biological research program by stepping up Service conducted investigations and encouraging cooperative research with qualified scientists and established research institutions. Similarly the Division of Ranger Activities was given specific and increased responsibilities for the protection and management of biological resources. Coordination of these activities will provide the greater attention required if the fish and wildlife and other animals of the National Park System are to be adequately preserved for public enjoyment.

INFORMATION AND PUBLICATIONS

As park visitation set new records and the Mission 66 program moved into high gear, public interest in the National Park System was reflected in an unprecedented demand for factual reports and publications dealing with the 180 areas of the System.

To meet this demand the Service produced some 12,000,000 informational publications for distribution in the parks and to respond to inquiries from all over the United States and many foreign lands. The Washington Office alone responded to 55,000 inquiries for information.

Supplementing the free informational program was the publication of handbooks on the historical significance and natural history of park areas, and the scientific findings of researchers in the parks. During the year four new handbooks—Theodore Roosevelt and Badlands, Dinosaur Quarry, Scotts Bluff, and Montezuma Castle—were added to the series and the Hopewell Village Historical Handbook was revised. These handbooks are sold by the Superintendent of Documents for a modest price. During the year nearly 500,000 Park Service publications were sold.

The informational program was strengthened during the year by the assignment of Regional Publications Officers to each of the Regional Offices with the primary assignment of improving the quality and timeliness of service publications.

The public was kept informed of the progress of Mission 66 through releases issued by the Washington Office concerning events of national interest. Park Superintendents issued informative releases on developments in their areas. Individual assistance was given numerous writers for magazines, newspapers, radio, and television stations and motion picture companies.

Staffing

Mission 66 provides for additional interpretive personnel in the parks and monuments. In the past year a total of 39 new permanent interpretive positions was filled by naturalists, historians, and archeologists. These men, and the larger numbers of seasonal personnel, accounted for the increased visitor services rendered in 1958, and enabled the National Park Service better to meet its responsibilities to ever increasing numbers of park visitors.

Commissions Established

Important celebration commissions established during the year pursuant to congressional acts included the Theodore Roosevelt Centennial Commission, the Civil War Centennial Commission, and the Abraham Lincoln Sesquicentennial Commission.

OPERATIONS

Following a study of the organizational structure of the Division, designed to promote more efficient operation, the protection functions of the Branch of Conservation and Protection became the Division of Ranger Activities, with the Maintenance Section of that Branch remaining in the Operations Division as the Branch of Maintenance. As reorganized, the Division was enabled more effectively to administer programing, concessioner management, land acquisition, and maintenance activities.

Despite increased pressures, construction programing during the fiscal year was more effective than ever before, large quantities of holdings were eliminated, many additional visitor accommodations were provided, and physical facilities were preserved and improved.

Legislation

Fulfillment of Mission 66 requires a broad and successful legislative program. Coordination and direction were provided for this program during the year and weeks before Congress adjourned, 18 items had been enacted in the second session. The financial restrictions which impeded administration of Virgin Islands National Park were removed. After many years an acceptable boundary was fixed for Everglades National Park. Exchange authority was obtained through which private lands in Olympic National Park may be acquired. The establishment of Fort Clatsop National Memorial was authorized to commemorate the successful crossing of the continent by the Lewis

and Clark Expedition. National Park status was made possible for Petrified Forest National Monument. The authority to grant concession contracts for periods up to 20 years was increased to a maximum of 30 years, thus assisting concessioners in financing large scale visitor accommodations called for by Mission 66.

New Program Adjustment Form

A special form was prepared and used for all development program adjustments. This form provides all data necessary for review and approval of program adjustments in a uniform and documentary manner. The new procedure is quicker and more efficient than the old memorandum system.

Accelerated Development Program

With the objective of strengthening employment, development projects proposed for execution in fiscal year 1959 were reviewed and those for which plans were well developed or required very little plan preparation were advanced to fiscal year 1958. Procedures were established for rapid handling of plan approvals and contract awards to facilitate getting the maximum number of projects under way. The result was the awarding of contracts for 39 roads and trails projects, 9 parkways projects and 58 buildings and utilities projects. Roads and trails and parkways projects were financed by advancing contract authority in the amount of \$14,765,500. Buildings and utilities projects were financed on a loan basis to the extent of 1958 projects which could not be accomplished this fiscal year.

Administrative Manual

Draft of the Programs section of the Administrative Manual was reviewed by Washington Office and Regions. Issuance of this section of the Manual is expected by August 1.

Program Meeting

Improved programing methods and procedures were developed at a meeting of all field programs officers held in Washington early in June. This was the first meeting of this group since establishment of the Branch of Programs in 1954.

Concession Authorizations

Seven concession contracts were negotiated during the year. The contracts called for construction programs at Mount McKinley and Grand Teton

National Parks, and Blue Ridge Parkway, representing investments about \$645,600. Highlights in this field were conclusion of contracts with Mount McKinley National Park Company to operate McKinley Park Hotel and related facilities in Mount McKinley, and Virginia Peaks of Otter Company to install and operate facilities on the northern portion of Blue Ridge Parkway which resulted from a prospectus issued last year.

Prospectuses

Three prospectuses were issued soliciting offers for operation of facilities at Lake Mead, Olympic, and National Capital Parks. No contracts have yet been negotiated as a result, although offers have been received in response to the National Capital Parks prospectus.

Concessioners' Improvements

The New Canyon Village concessioner development in Yellowstone was dedicated August 31, 1957, representing an investment in excess of \$6,000,000. A new concession building and an employee dormitory at Mount Rushmore, costing about \$700,000, were dedicated August 5, 1957. Lodge type accommodations, a trailer village and cafeteria were completed by Fred Harvey at the Mather area of Grand Canyon. The Everglades Park Company development in Everglades National Park, consisting of overnight accommodations, restaurant and lounge, and marine facilities at Flamingo, costing about \$900,000, was completed. Also, concessioner construction and improvement programs were completed at Mammoth Cave, Big Bend, Carlsbad Caverns, Crater Lake, Glacier, Isle Royale, Olympic, Rocky Mountain, Shenandoah, Bryce Canyon, and Yosemite National Parks, Canyon de Chelly and Statue of Liberty National Monuments, Lake Mead National Recreation Area, and Cape Hatteras National Seashore, with investments totaling about \$1,332,609. Major construction programs were also undertaken at Yosemite by Yosemite Park and Curry Company and Egan, Donohoe, Inc.

Concession Booklet and Reports

A new and popular booklet, Visitor Accommodations in Areas Administered by the National Park Service, was published; a report on the review of concessions and special use permits for service operations at National Capital Parks was submitted to the Secretary; an interim report on additional overnight accommodations planned under Mission 66 was submitted to the Assistant Secretary; and a study of the

feasibility of constructing and operating overnight facilities at high elevations in Mount Rainier, being financed by Jackson Hole Preserve, Inc., was commenced by a private firm.

Special Uses of Park Lands

The majority of special use permits issued during the past year continued to be for agricultural use of small parcels of land to maintain historical and rural scenes, for access facilities from private lands to park roads, and for utility lines.

The number of requests for information on prospecting and mining in national parks and monuments and vacation cabin sites in national recreation areas remained about the same as in previous years.

Water Resources and Water Rights

Testimony concerning water use and needs in the 21 Service areas in the Lower Colorado River Basin was presented in May 1958 at the Federal intervention in the suit between Arizona and California before the Supreme Court. Condemnation of the Saratoga Springs Tract of 160 acres and appurtenant springs and water rights at Denali Valley National Monument and of private interests, including wells and springs, on 24,699.22 acres in the southwest portion of Organ Pipe Cactus National Monument was completed after several years of effort to identify owners and define interests. The suits were filed as a friendly move to clear title.

Maintenance

A study, fundamentally engineering in character, was made to consider the feasibility and practicability of providing year-round service for visitors to Yellowstone National Park. The study group was composed of a representative from the State Highway Department of Colorado; a consultant, formerly with the California State Highway Department; a representative from the American Automobile Association of Denver; and a representative from the Bureau of Public Roads, as well as Service personnel. Highway Department representatives from Idaho, Montana, and Wyoming participated in the study as observers. The Snow Survey Committee concluded that while it was possible to keep interior roads and entrances open on a year-round basis, this was not practical since the estimated potential maximum load was only 140 vehicles a day during the winter. The Committee recommended target dates of November 1 and May 1 for closing and opening, except in the case of the Co-

(City-Red Lodge road where their recommendation was October 15 and June 1. The findings of the Committee have been endorsed and approved as target dates for subsequent years.

ADMINISTRATION

Appropriations

The Service's financial position was further strengthened through increased appropriations for 1958, the second year of the Mission 66 program. A comparison of the 1958 appropriations with those for 1957 is as follows:

| Appropriation item | 1957 fiscal year | 1958 fiscal year | Increase (+) or decrease (-) |
|---|------------------|------------------|------------------------------|
| Management and protection..... | \$11,562,000 | \$14,150,000 | +\$2,588,000 |
| Maintenance and rehabilitation of physical facilities..... | 10,158,000 | 11,600,000 | +1,442,000 |
| General administrative expenses..... | 1,250,000 | 1,330,000 | +80,000 |
| Construction..... | 15,250,000 | 17,400,000 | +2,150,000 |
| Construction (liquidation of contract authorization)..... | 29,800,000 | 31,000,000 | +1,200,000 |
| Total cash appropriations..... | 68,020,000 | 75,480,000 | +7,460,000 |
| Construction (amount by which roads and trails and parkways contract authorization exceeds or is less than cash appropriation)..... | -6,300,000 | +15,765,500 | +22,065,500 |
| Total new obligational authority..... | 61,720,000 | 91,245,500 | 29,525,500 |

Of the total increase in cash appropriations, about \$1,140,000 was for contributions to the United States Civil Service Retirement Fund authorized by Public Law 854 approved July 31, 1956. The increase of \$29,525,500 in total new obligational authority includes \$4,765,500 of 1959 fiscal year contract authorization, as provided in the Federal Aid Highway Act of 1956, which was advanced for obligation during 1958 as an economy stimulating measure. This advance enabled the Service to get under way during the last quarter of the fiscal year the greatest amount of construction work that has ever been gotten under way during any comparable period in its history.

Program for Improvement in Financial Management

Continued progress was made throughout the year in the prosecution of the Service's plan for improvement in financial management. Work continued on development of the new accounting manual which is now about 90 percent complete and which is being used throughout the Service in draft form. A significant improvement in financial management was realized during the year from operations under the new accounting system, particularly in accounting control over

the accelerated construction programs. Another item worthy of mention in the Financial Management Improvement program was completion of a study to determine what changes, if any, in the Service budget structure were necessary to synchronize it to the fullest extent possible with the organizational structure. The study was completed and at the close of the fiscal year recommendations resulting from which we feel will bring about substantial improvement in the Service's budget and accounting operations, were being considered by the Department.

Completion of Visitor Fee Study

During the year the study of the Service's visitor fee system, which was commenced in 1955 in accordance with a recommendation of the Organization and Management Survey but which was suspended prior to completion, was resumed and completed. Recommendations for changes in the fee system were submitted for the Secretary's consideration.

Employment Development

The Service's 18th General Administration Training Course was conducted in April in Santa Fe, N. Mex., for 27 selected Region Thru-men.

Various improvements in the Service's training program were developed, including an employee training record form and a requirement for counseling employees to encourage their self-development through additional training or lateral transfer.

Classification and Wage Matters

The most noteworthy development in this area was the approval of new position classification standards for park rangers, replacing standards dating from 1948. Based on the new standards, nearly nine-tenths of all park ranger positions have been up-graded, thus putting the Service in a much more favorable position for recruiting and retaining high-caliber men as park rangers.

Also, the Service participated successfully in the newly inaugurated voluntary program for the coordination of wage surveys among Federal agencies.

Recruitment

Reflecting widespread changes in economic conditions, we experienced throughout the Service a tremendous increase in applications



BEFORE AND AFTER.—Above the historic Beauregard House in Chalmette National Historical Park, near New Orleans, La., as it appeared before reconstruction got underway under the Mission 66 program of the National Park Service. The restored mansion as dedicated as a park visitor center and headquarters on May 18, 1958, appears on page 300.

for seasonal positions and for positions not requiring extensive training or experience. Architects, landscape architects, and engineers as well as biologists, archeologists, and stenographers, continued to be in short supply.

Employee Relations

Our participation in the Department's incentive awards program received a great deal of attention from top management in Washington and throughout the Service. Participation rate markedly exceeded 1957 accomplishments with respect to cash awards for superior performance and at least equaled 1957 with respect to suggestions and honor awards. The Service's recommendation of a Conservation Service Award for the Jamestown Glass House Foundation, Inc., was approved by the Secretary.

New Branch Established

Through consolidation of the functions of the Branch of Office Services and the property management functions of the Branch of

Finance, a Branch of Property and Records Management was established in the Division of Administration. This change puts great emphasis organizationally on staff responsibility for property and paper work management functions, which, we believe, is a step in the right direction, although more remains to be done. The Branch is broken down into Property Management, Records Management and General Services Sections.

Property Management

In the property management field, special attention has been given to the preparation of material for the property management portion of the National Park Service Administrative Manual and to a handbook on purchasing and contracting. A Museum Records Handbook was written, published, and placed in use and substantial headway has been made in establishing satisfactory museum specimen records. At the year's end, consideration was being given to the application of automatic data processing techniques to property accounting.

CHALMETTE NATIONAL HISTORICAL PARK, Louisiana. Dedication of restored Chalmette Mansion as modern visitor center, 1958.



Records Management

The Records Management Section has been assigned the responsibility for coordinating and directing the revision of the National Park Service Administrative Manual as part of our directives management program. Notwithstanding personnel limitations, encouraging progress is being made in that field as well as in forms, reports, and correspondence management. Much progress has been made throughout the Service during the year in the field of paper work management, including records scheduling and disposition.

General Services

Both the Mail and File Units of the General Services Section were reorganized to provide more effective and efficient operations required to keep abreast of the increasing volume of work resulting from the expanding programs of the Service. A physical inventory of all Washington Office nonexpendable property was undertaken and completed by the Supply Unit with the cooperation of all offices. One additional position was authorized for the General Services Section during the year, modern equipment was installed, and improved methods adopted. Operations reached a higher level of efficiency and further improvement is dependent on authorization for the employment of several additional people.

Orientation and Refresher Courses

A more thorough and uniform training program for clerical and stenographic personnel was undertaken and an instructor's guide is being prepared to assist in the continuing training of this important occupational group.

Correspondence Handbook

Correspondence instructions are being revised and put into handbook form for ready reference by personnel concerned with correspondence preparation. The job was nearing completion as the year ended.

Visitor-Accident Fatalities

With an increase of 7.9 percent in the number of visitors in the calendar year 1957, there was a decrease of 14 percent in the number of visitor-accident fatalities. Motor vehicles and drownings continued as the two leading causes of visitor-accident fatalities.

Motor Boats

Activity increased during the year on small boat safety. As a result of the report of the Bonner Committee, a National Conference on Small Boat Safety was called by the United States Coast Guard, which the Service sent two representatives.

Special Training Course for Employees

Through the cooperation of the Coast Guard, arrangements were made for eight employees of the National Park Service to be given training to enable them to examine applicants for licenses to operate motor boats carrying passengers for hire on nonnavigable waters areas administered by the Service.

Organization

The Branch of Safety has been handling both employee and visitor safety for many years. In an effort to carry out the responsibilities more efficiently, a study was made during the year to reorganize the Branch of Safety and allow more time for the program of employee safety. The Chief Safety Officer as Vice Chairman of the Department Safety Council has been cooperating with the Department in its employee safety program.

DESIGN AND CONSTRUCTION

General

The construction programs of the National Park Service during 1958 fiscal year involved a cash availability for all purposes, including previous year carry-over balances and advances of contract authority, of \$72,223,431. Of this amount approximately 96 per cent had been obligated at the close of the fiscal year. This accomplishment involved the award of approximately 540 individual construction contracts and the completion of many day labor projects.

In addition, to meet the design and construction demands of an extremely diversified and extensive program without expansion of the design office forces, approximately 27 contracts for professional architectural and engineering services were entered into with commercial firms or individuals.

The optimum use of services available under cooperative agreements with the Bureau of Public Roads, the Public Health Service and the United States Forest Service was continued, as were student assistant and trainee programs.

roads and Trails

Major road projects totaling \$25,750,000 were started. Completed projects amounted to 175 miles at a cost of \$9,728,000. The sum of \$626,000 for additional work was obligated prior to June 30 raising the total work under construction to \$32,142,000. Of this, 1959 fiscal year projects accounted for \$8,800,000 which were obligated or advertised for obligation by June 30, through advance contract authorization.

Completion of the final stages of construction on three park routes opened 76.5 miles of new roadway to the public, namely, the Stevens Canyon Road, 18.5 miles, in Mount Rainier National Park, the 21-mile East Side Highway in Grand Teton National Park, and the Park Road, 37 miles in Everglades National Park. Grading and base construction on the 20-mile gap on the trans-mountain Tioga Road in Yosemite National Park was placed under contract. Reconstruction of the Kings Canyon Route, 8.8 miles serving the Cedar Grove area and the Copper Creek trailhead was completed.

Parkways

Parkways construction reached its greatest volume since 1933. A \$60 million contract authorization was provided by the Federal Aid Highway Act of 1956 and an accelerated program begun in April. Programmed were \$6,515,800 for the Blue Ridge Parkway in North Carolina and Virginia, \$1,031,300 for the Foothills Parkway in Tennessee, \$3,528,000 for the George Washington Memorial Parkway in Maryland and Virginia, \$4,478,900 for the Natchez Trace Parkway in Alabama, Mississippi, and Tennessee, \$146,000 for the Rock Creek and Potomac Parkway in Washington, D. C., and \$300,000 for advance planning. These funds were concentrated to provide additional public service facilities and to close gaps in parkway construction to permit continuous travel on the Blue Ridge Parkway between Roanoke, Va., and Asheville, N. C., and between Balsam Gap, N. C., and Great Smoky Mountains National Park; on the Natchez Trace Parkway between Tupelo, Miss., and Jackson, Miss., and extensions of the George Washington Memorial Parkway from Spout Run to the Central Intelligence headquarters at Langley, Va.

On June 30, contracts totaling approximately \$29,212,000 were in process under the Bureau of Public Roads program, including 125 miles of paving, 108 miles of grading and base course, 42 bridges, 29 mile separations, tunnel lining, slope stabilization, and guardwalls. Parkway contracts totaling approximately \$4,400,000 on 16 major projects including 23 miles of grading, 9 bridges and grade separations, guardwalls, and guardrails were completed.

Advisory service was provided to the State Highway Department of Illinois, Kentucky, Mississippi, and Missouri, for field studies of the proposed Great River Road along the Mississippi River.

Buildings

The building construction program alleviated to some extent critical shortages of facilities for visitors in the following National Parks and Monuments: Visitor centers were completed at Flamingo, Everglades; Organ Pipe Cactus, Andrew Johnson, Craters of the Moon, Chalmette, Dinosaur; Colter Bay, Grand Teton; and Canyon, Yellowstone. Visitor centers are under construction at Abraham Lincoln, Hopewell Village; Dickey Ridge, Shenandoah; Pipestone, Moores Creek, Badlands, Mammoth Cave, Theodore Roosevelt, Bryce Canyon, Fort Union, Aztec Ruins, Petrified Forest, Saguaro, Richmond Battlefield; Eielson, Mount McKinley; and Grand Teton. Plans are in preparation for visitor centers at Gettysburg, Wright Brothers, and Cumberland Gap. The visitor center at Death Valley is being constructed in collaboration with the State of California which is sharing the cost and providing museum facilities.

Restoration and rehabilitation of historic buildings included the home of Andrew Johnson; the Schuyler House, Saratoga; structures at Appomattox Courthouse, Hopewell Village, Chalmette, Fort Laramie, Independence, and Harpers Ferry.

The recording program of the Historic American Building Survey was resumed in the 1958 fiscal year after being suspended since the beginning of World War II. Through the student assistant program measured drawings were completed for many historic buildings in Service custody not previously included in the Survey. Drawings were finished on partially completed surveys remaining after suspension of the work in 1941. A supplement to the Catalog of the Measured Drawings and Photographs of the Historic American Building Survey in the Library of Congress is nearing completion which will list the surveys received subsequent to its publication in March 1958. The Service is collaborating with the American Institute of Architects in its Historic American Buildings Inventory and is contributing to and participating in research and experimentation with Ohio State University in recording buildings through photogrammetry, a process of obtaining measured drawings of building elevations and interiors from photographs.

The employee housing program during the year provided for 6 new permanent dwelling units and 53 seasonal units. This compares favorably with 101 permanent and 47 seasonal for the preceding year and 121 permanent and 57 seasonal units programed in 1959.

Other major items constructed were comfort stations in campgrounds, utility buildings, and administration buildings. Additional overnight accommodations, housekeeping cabins, and shelters are under contract at Isle Royale National Park.

The concessioners in Big Bend, Yosemite, Everglades, and other National Parks are adding facilities to better serve the visitors and keep up with the Mission 66 program.

Utilities and Miscellaneous Structures

Continued progress in the development, improvement, and augmentation of utilities and miscellaneous structures and facilities is reflected by the following general statistics:

NEW VISITOR CENTER, DINOSAUR NATIONAL MONUMENT.—This unique structure built against the side of a cliff in which are entombed fossil bones of hundreds of dinosaurs, was dedicated as a Mission 66 project in June 1958. Visitors can view the embedded fossil bones of the prehistoric creatures while watching scientists at work recovering the remains in the fabulous dinosaur quarry



There was a net gain of approximately 1450 camp sites in 47 of campgrounds, including newly developed campgrounds and additions to existing campgrounds. Work was completed on 61 water systems and 43 sewer system projects involving a net increase in available water storage of about 8,161,000 gallons, all representing a capital investment of approximately \$3,110,000.

Work completed under the minor road and trail program approximately \$1,800,000. It included the completion of approximately 5.8 miles of new road, 5.9 miles of stage construction on additional new roads, and reconstruction work on approximately miles of old roads. In addition, work was completed on 3.3 mile new trails and reconstruction on 13.3 miles of existing trails.

The loan of two LCU's for use as free, State operated ferry boats at Cape Hatteras National Seashore Recreational Area was negotiated with the Navy along with the loan of an LCVP for administration and protection on Fontana Lake in Great Smoky Mountains National Park. The Corps of Engineers transferred several hundred feet of aluminum bridge sections for urgently needed bridge replacements at Great Smoky Mountains and Shenandoah National Parks.

Approximately 21 communication systems were converted from Government to commercial operations and maintenance. A new power generation and distribution system for the headquarters and Isle Royale Lodge areas of Isle Royale National Park was completed. Negotiations were well advanced to bring commercial power and phone service to Yellowstone National Park.

The 165-foot all steel passenger and freight vessel to serve Isle Royale National Park was launched on June 21, and a contract awarded for the deep water dock to serve it at Rock Harbor. Work was to be completed during the summer.

The Chief Engineer participated in Operation Alert, 1957-1958 under a preplanned decentralized emergency operations organization coordinated with the departmental program.

Master Plans

Master plans were kept well ahead of construction programs so that the work could be thoroughly coordinated with other divisions of the Service. A study was made to assure the close integration of the Master Plan Development Outlines and the Mission 66 project spectuses. This will greatly facilitate the operation of the construction and development programs. A total of 290 master plan drawings was approved, and 168 preliminary studies were prepared and reviewed.

RECREATION RESOURCE PLANNING

Park System Planning

A long-range National Park System Plan was begun as part of the Mission 66 program. This plan for the orderly rounding out of an adequate system of nationally significant areas in appropriate classifications is to be completed by 1961. It will help to chart the way for selecting and preserving, while still available, outstanding scenic, scientific, and historic areas so that the Nation's future park needs may be fulfilled.

New Areas Established

The site of Fort Clatsop, near Astoria, Oreg., winter camp of the Lewis and Clark Expedition, was authorized to be established as a national memorial by the act of May 29, 1958. Petrified Forest National Monument in Arizona was authorized as a national park by the act of March 28, 1958. The park status becomes effective when inholdings are acquired.

New Areas Proposed

Legislation pending in Congress would authorize establishment of national parks on Cape Cod, Mass., and Padre Island, Tex.; preservation of an undeveloped stretch of the Indiana dunes on the shore of Lake Michigan as a national monument; and transfer of Grant's Tomb in New York City to Federal ownership as a national memorial. Other pending legislation would create a Grand Portage National Monument in Minnesota. A small tract there is now a national historic site in non-Federal ownership.

Designation of the old United States Mint building in San Francisco as a national historic site is being considered by the Secretary. The General Services Administration has agreed to transfer the building to the custody of the National Park Service when renovation of the new Mint building is completed.

Russell Cave in Alabama, rich in evidences of early man, was formerly offered by the National Geographic Society as a national monument. The Society is completing acquisition of the land needed for such monument purposes.

A full-scale study was made of the possible preservation of Fort Huachuca, historic Arizona army post, as a national monument. Preservation of the Kinishba Ruin in Arizona as a national monument was studied in preparation for discussions with Apache Tribal Comm-

cil and Bureau of Indian Affairs representatives. Investigations continued to ascertain what grassland areas remain available for possible preservation as specimens of America's once-vast prairie.

An extensive area of the glacial moraines of Wisconsin has been suggested as a possible unit of the National Park System, and study of it have been authorized.

Area Abolishment

On November 1, 1957, the Millerton Lake National Recreation Area was officially transferred to the State of California for administration.

Boundary Adjustments

During fiscal year 1958 Congress authorized additions to White and Fort Frederica National Monuments, a land exchange at Big Bend Canyon of the Guadalupe National Monument, and conveyance of land in Tennessee of land at Shiloh National Military Park for highway purposes. Small additions to Tumacacori and Fort Vancouver National Monuments were authorized by Presidential proclamation. A major enlargement of Fort Vancouver has been recommended. Enacted by Congress and signed July 2, 1958, by the President was a bill designating new boundaries for Everglades National Park, thus resolving many long standing boundary problems there.

Bills introduced in Congress during the past fiscal year would provide administrative sites outside park boundaries at Yosemite and Mount Rainier National Parks; authorize a land exchange at Valleyburg National Memorial Park, and permit the use of Federal funds to acquire additions to Antietam National Battlefield Site and Clatsop National Historical Park. Other bills would permit the Secretary to procure additional land for Edison Laboratory National Monument and would transfer two federally owned tracts to Hatteras National Seashore.

The President has been asked to add two islands to Fort Pulaski National Monument by proclamation; other proposals would add lands to Capitol Reef National Monument and adjust boundaries of Arches National Monument. Material enlargement of Cabrillo National Monument is proposed. The National Park Service applied to the Bureau of Land Management for withdrawal of a site for Katmai National Monument headquarters.

Advisory and Consultative Assistance

On 447 occasions, State and local agencies in 47 States were furnished assistance on a variety of problems. Of particular significance

as assistance to Arizona, Colorado, and Utah in planning for their first statewide park systems and to several other States in similar long-range planning programs. In addition, assistance was given to the Fish and Wildlife Service in planning for recreation use of free areas and to three Indian tribes on recreation-area planning and development.

The scope and value of Service assistance was substantially increased by the addition of an experienced Interpretive Specialist to advise on development and operation of interpretive programs.

Park Practice Program

Numerous "bouquet" letters and word-of-mouth commendations from Federal, State, and local park and recreation authorities indicate the increasing value of the publications issued under this program. Over 600 subscribers now receive the three publications issued by the National Conference on State Parks under this cooperative program, namely, Design sheets illustrating park and recreation structures, guideline sheets dealing with policy, planning, development, and other aspects of park administration, and Grist, an illustrated bi-monthly information letter on operation, time and money-saving devices and methods, etc. Additionally, nearly 2,500 copies of Grist are sent to full subscribers who receive multiple copies and to others who subscribe only to this publication.

Disposal of Real Property

The Service investigated and reported on 41 applications submitted by the States and their political subdivisions to General Services Administration to acquire a total of 1,996 acres of Federal surplus real properties for park, recreation, and historical monument purposes. A total of 172 such properties involving 33,948 acres has been investigated since they first became available in 1948. Enforcement of compliance with the conditions in the deeds for a period of 20 years has increased each year since 1948, until now the Service has such responsibility on 116 properties involving 24,223 acres. The Service also reported to the Bureau of Land Management on 38 applications by State and local agencies to lease or purchase public domain lands for park and recreation use.

Landscapes of Alaska—Their Geologic Evolution

This handsomely illustrated 146-page book, prepared by staff members of the Geological Survey, edited by Howel Williams, and pub-

lished by the University of California Press, is the latest of the series of reports on the Service's Alaska Recreation Survey which was initiated in 1950 as an integral part of the Department's Alaska program. The publication reveals to the lay reader an understanding and appreciation of the geological evolution and significance of Alaska's magnificent scenic resources.

State Park Statistics—1957

This 32-page processed edition reveals 2,216 State parks and related types of recreation areas embracing over 5 million acres; expenditures of \$32 million for lands and capital improvements; \$12 million for operation and maintenance; 6,302 year-round and 9,141 seasonal employees; and more than 216 million attendance, nearly 15 million of whom were overnight visitors.

Regional and Basin-Wide Recreation Surveys

Major investigations of the recreation potentialities of river basins were conducted in the Missouri, Delaware, and Columbia Basins, and in the northwestern California region. The year marked the termination of a 3-year survey to provide a recreation land-use master plan for the Department on reclamation withdrawn lands along the Lower Colorado River, covering about 250 miles from Davis Dam to the Mexican border.

The report on the Missouri River Basin-Wide Recreation Survey has been accepted by the Inter-Agency Committee and recommended for publication. The report on recreation resources of northwestern California was completed and sent to print.

Preparatory to development of long-range recreation resource planning reports, field work was begun on surveys in Alaska, under contract for a special study, and in Hawaii, through joint investigation by Service personnel and the Territorial Planning Office in Hawaii. A contract was signed for a similar survey of the Virgin Islands.

Recreation Research

Special studies, made under contract for the Service, included a population study of outdoor recreation activities and preferences of the population living in the region of the Delaware River Basin; a study to determine the trends in extra-urban parks and recreation areas and their adequacy in serving the recreation habits, needs, and preferences of persons in large urban areas; and an economic analysis of recreation in northwestern California.



FIRST HOMESTEAD.—Three young citizens gaze with wonder at the log cabin on the site of the first homestead claimed on January 1, 1863, minutes after the Homestead Act. The first homestead is protected by the National Park Service in Homestead National Monument near Beatrice, Nebr.

Plans were made for an economic impact study, to be cosponsored by the Bureau of Reclamation, on recreation values resulting from a selected group of completed reservoirs in Nebraska. A contract was signed also for a study of organized camps to provide information necessary for formulating a program to adequately meet the needs of children aged 9 to 16.

Reservoir Development and Management

Studies continued in the spectacular Glen Canyon Reservoir area. Preliminary planning reports were prepared on the Navajo and Flaming Gorge units of the Colorado River storage project. Studies at Flaming Gorge indicated that the recreation phases of this future reservoir will be of national significance.

The Secretary, on April 21, designated the Service as the agency responsible for carrying out provisions of Section 8 of the Colorado River Storage Act, which provides that the Secretary is authorized and directed to investigate, plan, construct, operate, and maintain public recreation facilities on the several reservoirs and participating projects.

Recreation reconnaissance or planning reports were prepared on Bureau projects and 7 reconnaissance reports were prepared for the Corps of Engineers. Reviews were made of 35 applications for Federal Power Commission permits or licenses.

RANGER ACTIVITIES

Park Rangers

The Park Ranger in his forestry green uniform and broad-brimmed hat is a familiar figure to the millions of people who visit the National Parks. They know him for his courteous and friendly manner and his willingness to take a personal interest in seeing that they get the enjoyment from their visits. No other agency of the Federal Government provides such a varied and extensive service, in such a direct, personal, and face-to-face manner, to so many citizens of our country.

This year approximately 60,000,000 visitors were assisted by a Park Ranger. In doing his job well he has earned the respect, admiration, and gratitude of his countrymen and is becoming a national symbol of the best in Government service.

In addition to protecting and providing services to an ever-increasing number of visitors, Park Rangers achieved a high degree of success in protecting and regulating the use of National Parks and the forests, wildlife, and many other important scenic and scientific features. Intensive study is being devoted to ways of strengthening the ranger staff, to permit them to cope with a growing, and already near-overwhelming, workload.

The establishment of a Division of Ranger Activities in the Washington Office during this year, as a part of the Mission 66 Program, was an event of outstanding significance to the Service and particularly to Park Rangers. For the first time this large group of employees, and the many important functions for which they are responsible, has been given status as a division in the Service organization. This new Division has a Branch of Park Forest and Wildlife Protection and a Branch of Visitor Protection. Its implementation in each of the Service's Regional Offices will be accomplished as soon as funds are available.

Also of unusual importance was the development, approval, and application of a new set of Civil Service Classifications Specifications for Park Ranger positions. This action resulted in the upgrading of approximately 80 percent of these positions.

Water Use

Water related activities are surging ahead in visitor popularity and compound enjoyment for many and to also compound Service

responsibilities for safety and the conservation of a natural resource delicately balanced in an atmosphere yielding to both serenity and sports diversions. A boating committee with wide representation is presently developing policy and regulatory recommendations in line with prime objectives.

Winter Use

There is a trend toward an extended annual period of general Park use. People are, except under conditions of climatic extremes, taking advantage of improved roads, transportation, year-long accommodations, longer and less seasonal vacations to explore the out-of-doors. Recreation in the snow and the beauty of winter landscapes are becoming more attractive to increasing numbers and the Parks are thereby serving a fuller purpose.

Mountaineering

A total of 19,191 persons, representing 1,154 parties or groups, participated in recorded mountaineering activities in 10 of the Parks and monuments drawing the special attention of those interested in this form of relaxation. This compares with 18,049 registered mountaineers last year.

There were 3 fatalities and 13 serious injuries. Park Rangers effected 20 rescue and evacuation operations of major proportions. Training and equipment stores were expanded and improved.

Camping

An expanding interest in camping was shown by the recorded increase of 15.6 percent from 3,633,000 camper days in 1956 to 4,201,000 in 1957. Field studies have been undertaken to establish uniform methods for collecting travel statistics and more closely relating visitor use to the requirements of staffing and physical improvements.

White Pine Blister Rust Control

Work in 14 areas has progressed for control of white pine blister rust on 376,239 acres to the extent that the ribes (wild currants and gooseberries), the alternate hosts of the disease, have been initially removed from 91 percent of the control area. Seventy-seven percent of the control area is now on a maintenance status which means that only periodic workings are required to keep the areas "ribes free."

Forest Fire Control

Forest fire prevention and control activities were unusually successful, for not in the past 25 years have so few man-caused fires been

fought. However, camper-caused fires were more numerous than during any previous year, but still a small number considering the record visitation to the parks. Fires caused by lightning almost equaled the annual average for the past 30 years. A large fire in the Everglades National Park, which spread over a large acreage of grassland, was primarily the reason the total burned area exceeded the 30-year average. Despite this fire, the forest land damaged was only 36 percent of the annual average.

Grazing by Domestic Livestock

The grazing by domestic livestock under permit within the western national parks and monuments is continuing with little change. The ultimate goal of eliminating this nonconforming use will not be attained for a number of years because of the tenure of the permits. However, an accelerated fencing program has reduced some trespassing and is eliminating grazing in areas having high park value. An example of the latter is the cactus forest at Saguaro National Monument.

Forest Pest Control

For the past several years a Southern pine beetle epidemic has been a serious problem in Great Smoky Mountains National Park. Reduction of the beetle population has been difficult because of aggressive attacks by 5 and 6 generations per year. Through concerted action and other factors control now has been established.

Maintenance control projects for a number of pests have kept vegetation losses to a minimum. The persistent attacks of the Black Hills bark beetle have required several seasons of cooperative effort by personnel of Bryce Canyon National Park and the Dixie National Forest to place the status of this pest on a maintenance basis. Also the spruce budworm control project in Yellowstone National Park appears to have been successful.

Research to determine means of control of forest pests, both pathological and entomological, has usually been devoted primarily to pests whose host trees have commercial values. Knowledge to control a number of pests of noncommercial species which have high scientific or recreational values in the parks has been lacking because of this emphasis. Recognition by the entomologists and pathologists of this situation is now evidenced by several pilot test control projects on pests that are seriously damaging park values such as the lodgepole pine needleminer in Yosemite and the pinyon pine scale at Grand Canyon.

Wildlife and Fish Management

Biological activities relating to wildlife and fish have been separated into research and management. The Division of Ranger Activities is responsible for management programs.

The large elk herd of northern Yellowstone continues to be a pressing problem. The mild winter caused the reduction program to fall short of the required number to bring the herd within the carrying capacity of the range.

The management program for the Teton elk herd continued to receive field study.

NATIONAL CAPITAL PARKS

Administration

Upon the completion of the first year under the new reorganization, many of the recommendations of the 1957 Survey Report on National Capital Parks have been effected, including the establishment of the position of Advance Planner in the Superintendent's office.

Public Use and Interpretation

More than 15 million persons by actual count participated in public use activities in the parks, which included 6 million visitors to the major national memorials, an attendance of 3 million persons at 233 special events, and the participation of 1,093,149 persons in the interpretive programs conducted by park naturalists and historians. An additional estimated 15 million persons actively used public park facilities—tennis, swimming, etc.—not covered by actual count, and an estimated 30 million persons engaged in various forms of less strenuous recreation in the parks. The Custis-Lee Mansion museum was formally dedicated and opened to the public on June 1, 1958.

Protection

The United States Park Police continued protective services helping to keep the parks relatively free from serious crime. Some 2,827 courtesy traffic warnings were issued in line with the courtesy program for out-of-town visitors. Cooperative services with the Training Division of the International Association of Chiefs of Police, the International Cooperation Administration, and with the International Education Exchange Service of the Department of State were continued.

Physical Improvements

Contracts for 18 major projects included the construction of bridges: the reconstruction of Beach Drive in Rock Creek Park; restoration of the Old Stone House, floodlighting the Washington Monument, and completion of 4 recreation structures. Other projects near completion or under way include the floodlighting of the United States Marine Corps War Memorial, riding stables in Rock Creek Park and the Rock Creek and Potomac Parkway, and development of Belle Haven picnic area. Progress continued on the George Washington Memorial Parkway upstream from Key Bridge in Virginia and Maryland. Seventeen park reservations were rehabilitated by landscape treatment and installation of concrete curbing, benches and stone walks. Landscape work involved the planting of 16,000 trees and 4,657 shrubs. Some 2,751 new trees and 8,219 shrubs were placed in the park nursery; some 26,970 plants were propagated. 54,600 budding plants were set out in park displays.

Scientific Research and Planning

Research projects in agronomy were undertaken by the Pathologist's office. Master plans were developed for Fort Washington and Greenbelt Parks. Development plans are now in preparation for the Water Sports Center, the Rock Creek Nature Center, the Washington Monument Plaza, and parking areas in Rock Creek Park.

DIVISION OF AUDITS

Major reports completed during the year by the Division of Audits cover the following Service and concession operations: Division of Administration, National Capital Parks; Bandelier National Monument; Best's Studio, Inc., Yosemite National Park; Cape Hatteras National Seashore Recreational Area; Chickamauga-Chattanooga National Military Park; Degnan, Donohoe, Inc., Yosemite National Park; Everglades National Park; Fort Pulaski National Monument; Fort Union National Monument; Mrs. Evelyn Frey, Bandelier National Monument; Great Smoky Mountains National Park; Hainta Pictures, Castillo de San Marcos National Monument; Evelyn H. Inc., Statue of Liberty National Monument; Jefferson National Expansion Memorial National Historic Site; Arthur F. and Mario Lange, Grand Teton National Park; S. G. Loeffler Company, National Capital Parks; Morristown National Historical Park; National Trace Parkway; Olympic Hot Springs Company, Olympic National Park; Olympic National Park; Rainier National Park; Mount Rainier National Park; and Yosemite National Park.

The audit program is designed to provide an objective evaluation of financial management and other operations on a systematic and recurring basis. Many recommendations were made and accepted for improvement of controls over the use and safeguarding of assets, improvement of accounting records and supporting data to make them more useful to management, and recommendations concerning adherence to financial and operating policies, plans, and procedures. Findings of the audits of concession operations continue to show a need for improved internal controls and accounting records to provide the Service with accurate information for the administration of rates charged by concessioners and negotiation of franchise fees.

OFFICE OF TERRITORIES

Anthony T. Lausi, *Director*



ALASKA, the Nation's largest Territory and a rich reserve of virtually untapped resources, won its 42-year fight for Statehood in the waning minutes of fiscal 1958. On the last day of the fiscal year the Senate passed H. R. 7999, and the people of Alaska were assured a full partnership in the Union.

This historic development, long hoped for, overshadowed all other achievements in the Office of Territories which, following the Eisenhower Administration's policy of full support for Alaskan Statehood, had worked closely with the Alaskan Government in behalf of this measure.

(Estimates by the Governor and by Department officials that Alaskans would support Statehood by a margin of at least 5 to 1 in the referendum proved conservative. The margin of victory was even more pronounced, a plain demonstration that citizens of Alaska, regardless of political affiliation, were determined to cast off Territorial status and assume their rightful duties, responsibilities and privileges as members of the 49th State. Formal admission to Statehood necessarily had to wait until fiscal 1959).

Disappointingly—for the Administration is also pledged to Hawaii for Statehood—fiscal 1958 did not bring as much success for the "Pacific paradise." This did not mean, however, that Hawaiian Statehood had been defeated, but merely postponed. One of the Department's highest priority goals is that Hawaii shall become the 50th State in 1959.

In other Territories of the United States the fiscal year showed solid progress toward those goals which the Office of Territories dedicated to achieve.

From the Caribbean through the Pacific, our island territories improved their economic position, except for the Trust Territory of the Pacific Islands. The rate of economic activity there was high, but much of it was directed to repairing the damage from the

devastating typhoons. Guam also experienced a typhoon but the damage was smaller and its effects more quickly overcome. Almost every business index in Guam showed some improvement over the previous year.

In American Samoa, employment and wage rates both increased. Tourist income has grown as the number of visits of cruise vessels mounted. A start was made on a new international airport.

In the Virgin Islands, fiscal 1958 was a record-breaking year for tourist income. The Islands experienced the extremes of severe drought in the summer of 1957 which seriously curtailed sugar production, and unusually heavy rains in the spring of 1958 which brought welcome relief from problems occasioned by shortages of fresh water.

In Hawaii, despite a costly sugar strike, prosperity on the main island and of Oahu, where most of the population of the Islands is concentrated, assumed near-boom proportions.

Throughout all the Island Territories, education, health and construction plans and projects were carried out with enthusiasm and efficiency.

In Alaska, the Public Works program, nearing the end of its \$70 million congressional authorization, has continued to provide much-needed public facilities to many Alaskan communities.

ALASKA

The passage of the Alaska Statehood Act by the Senate on June 1958, marked the dramatic end of a fiscal year which auspiciously began with the discovery of oil on the Kenai Peninsula, near Anchorage, in July 1957.

The final vote, taken in the evening of June 30 after several days of debate, closed a long legislative struggle in the Congress. The Statehood bill for Alaska was introduced in the Congress in 1906. In the years following World War II, when the national attention was again focused on Alaska, the drive for Statehood gathered momentum. Every Congress since 1947 has had under consideration a bill designed to admit Alaska into the Union as a State.

With a growing sentiment in Alaska for Statehood, a constitutional convention was convened in late 1955 at the University of Alaska. The resulting document, ratified in April 1956 by an overwhelming vote, was accepted, ratified, and confirmed by the 85th Congress in enacting the Alaska Statehood Act, Public Law 85-508. The adoption of the constitution hastens the day when Alaska is formally admitted into the Union by Presidential proclamation, probably about January 1959.

In accordance with the terms of the Statehood Act, the Governor of Alaska speedily issued a proclamation calling for primary elections for State offices on August 26, 1958, and general elections November 25, 1958. The special election to vote on the three referendums set forth in the Statehood Act was also held on August 26, and resulted in an overwhelming display of patriotism by Alaska in electing to join us as the 49th State. President Eisenhower then issued his proclamation officially admitting Alaska into the Union after receiving certification of the final returns of the general election.

In the Territory, the Governor early in fiscal year 1958 took positive steps looking forward to Statehood. One of his first acts was to appoint an Advisory Committee on Taxes composed of members of the Territorial Legislature. The Governor charged the Committee with a review of Alaska's financial structure and asked that a comprehensive plan for a tax structure be drafted for submission to the next Territorial Legislature or the first State Legislature.

Strengthening Alaska's Economy

The Governor also called a procurement conference in November 1957 in order to promote more buying in Alaska by Government agencies. The conference discussion centered on steps which could be taken to channel more procurement and more spending through local Alaskan outlets, thus strengthening the Alaskan economy. Following the conference, the Governor worked closely with the Department of Defense in formulating a plan whereby local suppliers could compete on a more equitable basis with outside sources.

The 1957 Legislature had taken positive action to encourage industrial development through enactment of a tax incentive program under the jurisdiction of a Board of Administration. During fiscal year 1958, one new company qualified and received exemptions. A lumber firm was granted a 10-year exemption from Territorial income taxes, a 5-year exemption from motor fuel taxes, and a subsequent 5-year exemption from motor fuel taxes on stationary engines only. At fiscal year's end, the Board had under study an application for tax exemption from a pulp company which now has under construction a \$55 million mill at Sitka.

The beginning of construction of the Sitka mill in the foreground of the fiscal year marked greater realization of the timber potentialities of the great forests of southeastern Alaska. During the year, another private firm announced a proposal to utilize the extensive birch resources at Talkeetna on The Alaska Railroad.

Development

Announcement of the July 1957 discovery of oil on the Kenai Peninsula resulted in a flood of 11,492 lease filings during the following 11 months covering almost 28 million acres. The discovery well is reported to have a daily flow of 900 barrels. In order to encourage oil and gas prospecting in Alaska, the Secretary of the Interior took steps to make available for leasing some 20 million acres in northern Alaska which had been withdrawn in 1945. Revised regulations for leasing on wildlife lands in Alaska were published in 1957, following the enactment of Public Law 85-505, regulations were promptly issued calling for the same rental per acre on oil and gas leases as is charged elsewhere in the United States for Federal public land oil and gas leases.

Alaska Railroad

Operating revenues of The Alaska Railroad declined during the fiscal year as labor and materials costs increased. Despite this, the Railroad, through rigid economies and effective use of manpower and equipment, was able to produce a net income of \$109,016.62. As part of the continuing program to lower costs of operations and maintenance by improving facilities, ties were renewed and ballast relaid on about 45 miles of track between Anchorage and Wasilla. A similar project between Broad Pass and McKinley Park, covering a distance of about 44 miles, was 75 percent complete at the end of the year. Construction was completed on several new facilities including the marine terminal, yards and enginehouse at Seward, and a modern depot at Portage. An integrated microwave communications system was installed between Portage and Anchorage replacing the old line in use since the inception of the Railroad. The installation of this microwave system will eliminate recurring communications outages resulting from snow slides occurring during the winter months.

Twenty-six hopper cars of fifty on order were received and placed in service. Work of applying 12 sets of dynamic brakes to electric Diesel locomotives was completed in anticipation of operating economies due to better train handling, less wheel wear and brake wear, and other mechanical savings. Under force account, 56 freight cars were rebuilt, and a program of repairing hopper cars has been started on an experimental basis. A new paint shop was put into operation and the Railroad's entire box car fleet was sandblasted and painted.

Railroad officials who have visited Alaska have advised the management of The Alaska Railroad that its equipment is in many re-

spects superior to that of many private railroads. Continued industrial development resulted in location of additional warehouses in the Railroad industrial yard, and, through rate adjustments, the Railroad has been able to secure additional tonnage.

Alaska Public Works Program

In 1949, by Public Law 264, the 81st Congress authorized a \$60 million program of public works in Alaska to foster economic and social development through provision of facilities for communities.



This 100-man dormitory is one of 4 dormitories constructed at the University of Alaska under the Alaska Public Works program. The other three are: (1) another of the same type, (2) a 100-woman dormitory and (3) a married students' dormitory.

life. This 5-year act was later extended by Congress to June 30, 1959. Under this program the Federal Government, upon application by a public body, such as the Territory, a city, a school or utility district, finances the entire cost of construction of approved projects, contracts for their construction, and upon their completion, transfers them to the public bodies for whom they are built at prices that will return to the Treasury of the United States approximately 50 percent of the total cost of the program.

Through June 30, 1958, congressional appropriations totaling \$66,676,200 have become available. Allotments have been made to 13



the municipal water treatment plant was constructed in Fairbanks under the Alaska Public Works program.



classroom grade school erected under the Alaska Public Works program at Airport Heights near Anchorage.

projects, some of them including multiple facilities. These projects will provide 58 school units; 13 hospitals and health centers; municipal buildings; 46 sewer and water projects; 24 other types of facilities as streets, utilities, and small boat harbors; and 22 small miscellaneous units costing \$437,100 have been constructed by far account as an emergency relief measure. Of these, 123 projects costing \$45,253,721 have been completed. Another 17 projects estimated to cost \$10,559,200 are substantially complete and in use, and with an estimated value of \$8,376,550 are in the construction stage. Four projects expected to cost \$335,050 are in the planning stage and are expected to be under construction during the 1958 season.

In providing basic community facilities and other essential public works, this program is making a major contribution to Alaska. Although the fiscal 1959 appropriation of \$5,300,000 substantially exhausts the originally authorized \$70 million there are pending at the present time applications for needed facilities estimated to cost approximately \$30 million.

HAWAII

The 12th Governor of Hawaii, William F. Quinn, was sworn into office September 2, 1957. The Secretary of the Interior participated in the inaugural ceremony at historic Iolani Palace grounds in Honolulu.

Hawaii has entered a period of tremendous growth and expansion. Nearly every index of growth reflected this upsurge during the past year, in population, in the establishment of new businesses, and in construction. The building of homes and of commercial, industrial, and governmental facilities, including large-scale housing for military families, was sharply accelerated.

Hawaii's economy was able to withstand and recover rapidly from the impact of a costly 4-month-long strike in the basic sugar industry, a labor dispute that was settled after the Governor successfully intervened as a mediator.

The Territorial government is channeling its efforts for orderly growth through the newly created Territorial Planning Office and the older Economic Planning and Coordination Authority. The Planning Office is preparing a long range, comprehensive plan which will serve as a guide for the future physical and economic development of the Territory. A major project is the proposed development of Waikiki reef land for "Magic Island." The EPCA is helping to attract new enterprises through its services to prospective investors.

As the hub of the Pacific, Hawaii will soon build a new jet



Planes of many airlines and from many lands make Honolulu International Airport a bustling hub of the Pacific. Development of a jet-age airport and a new passenger terminal building is under way. Completion date of project is 1960.

port. After modernization and expansion, Honolulu Harbor will be able to accommodate more ships at this busy, maritime crossroads. During the 12-month period, the Territory effectively met the increasing need for more schools, and health and welfare services. Public housing and institutional care present continuing problems. The general prosperity enjoyed during fiscal 1958 has eased the financial burdens of the Territorial government. While this prosperity was centered on the main Island of Oahu, public and private agencies are cooperating to promote the greater economic development of the neighboring islands.

THE TRUST TERRITORY OF THE PACIFIC ISLANDS

Three typhoons of major intensity swept through the Trust Territory during the year, causing catastrophes of unprecedented dimensions. The first two typhoons passed through the Ponape, Truk, and Marshall Islands Districts, leaving some 1,700 people homeless and

without food, while the third storm struck in the Truk and Yap Districts, bringing additional destruction.

While administrative programs directed toward the advancement of the Micronesian peoples and their islands continued without cessation, emergency assistance and rehabilitation measures for relief of the typhoon victims took temporary precedence. Food, water and shelter, and aid in new plantings of subsistence as well as cash crops were speedily provided. Prompt action by the United States Congress in appropriating \$1,350,000 for disaster relief made it possible to initiate an orderly plan of rehabilitation throughout the area.

Greater strides were noted in the field of political development than in any previous year. One new districtwide congress was formed for a total of three such congresses and it is expected that another district will have a chartered district congress by January 1, 1959. In addition, 12 municipal charters were granted, and requests from other municipalities for chartering were being processed. Interest among the Micronesian people in the democratic processes was strengthened as administration teams, consisting of key Micronesians on district staffs, carried to the various municipalities information about how the various democratic processes work.

Revision of the Micronesian Title and Pay Plan was a major administrative step during the year. Two wage schedules for Micronesian employees were established, one for trades and mechanical type of work, the other for clerical, administrative, and professional positions. Continuing progress was made in promoting Micronesians to posts in the district administrations.

Due to the widespread destruction of subsistence crops by the typhoons, concentrated planting programs were set in motion in the storm-struck areas under the direction of district agriculturists. An intensive coconut-improvement campaign continued under a special plan in copra production, with emphasis upon scientific plantings for increased future production. Research for the development of the betelnut industry and the planting of cacao as a supplementary crop continued.

Programs for the control of agricultural pests were also continued and a plant pathologist was engaged to study plant diseases in the Territory. District agricultural centers were developed as demonstration projects, with a wide variety of new plant species introduced. Start was made on a subsistence fishing project and handicraft production was stimulated. Special freight rates were established to encourage export trade. Loans amounting to some \$436,000 were made to assist the Micronesian-owned trading companies in their growth.

As an addition to the small fleet of ships already operating inter-district and inter-district, a twin-screw passenger and cargo motor

vessel for field-trip service in Ponape District was nearing completion, and a smaller vessel to replace one destroyed in the typhoon was under construction for use in the Marshalls. Air transportation continued to be provided by three amphibious SA-16A planes operating to the districts on a weekly schedule. Additional islands were brought into the radio communications network.

Present and future construction plans in the districts are being made in accordance with master plans drawn for development of the district centers. Thirty-five construction projects were completed. These projects include dormitories, hospitals, schools, administrative buildings, warehouses, quarters, shops, garages, water tanks, power and refrigeration plants, transportation, and POL storage facilities.

A new Headquarters Scholarship program was added to district scholarships already in effect. Seventy Micronesians were pursuing college or specialized study outside the Trust Territory. In addition, some 125 students from the territory were attending high schools in Guam. At the Pacific Islands Central School in Truk, 48 were graduated. Approximately 10,000 students were enrolled in public schools in the Trust Territory and 2,500 in mission schools. Government assistance to augment the resources provided by local communities was provided for rebuilding schools devastated by typhoons. Work continued on construction of the new plant of the Pacific Island Central School.

Adult education work was promoted; 13 women's organizations devoted to the improving of home practices have been developed in the district. Teacher-training courses were held in the various districts during vacation periods, and American teacher-trainers continued to visit outlying areas to assist Micronesian teachers in their work. In one district daily radio programs were presented as a phase of adult education with emphasis upon health and sanitation. All local district newspapers were other mediums of adult education.

The Education Department took the initiative in aiding political development in various districts, and also participated with the Public Health Departments in joint health-education programs.

In all districts, continuing programs of training out-island health aides were in progress. Health education and training films were utilized. A School of Nursing for the Trust Territory, at Koror, Palau District, graduated nine. An epidemic of Asiatic flu was brought under control. Continuing TB survey and BGG immunizations were in progress in the various districts. A program was completed whereby all dental practitioners were given refresher courses at the Naval Hospital, Guam. The scope of public health statistical coverage was increased.

GUAM

Guam continued to show real progress in all its essential activities during the fiscal year 1958. The official visit to the Territory by the Secretary of the Interior gave impetus to these developments. This was the first visit to the Island made by a Secretary of the Interior since the enactment of the Organic Act in 1950. A vacancy, the Secretary of Guam, was filled by the appointment of Marcellus G. Boss.

In November 1957, Typhoon Lola struck the Territory with severe intensity causing over \$5 million in property damages. Emergency measures were set up for planning and coordinating the activities of Public Safety, Civil Defense, Red Cross, the District Commissioner, Public Works, Public Utilities, and the Armed Forces. The homeless and those without food were immediately taken care of by the Red Cross and the government of Guam. Under a "Help Your Neighbor Campaign" repairs, rebuilding, and assistance to residents were made with dispatch, and the Territory returned to normal within a few weeks after the typhoon. The military establishments aided the civilian population in many ways and provided large amounts of surplus materials to assist in the repair of damaged homes. Fortunately, there were no casualties.

The new Guam Memorial Hospital was occupied during the year. In the education field progress was made toward accreditation of the Territorial College by the Western College Association. A program

Badly needed new Guam Memorial Hospital, completed in September 1957.



to straighten out the land title records system was begun with the employment of two scholars to translate archaic Spanish land records in Guam, and with arrangements for a cadastral survey. Negotiations were also undertaken to procure the services of a large title insurance and trust company to review current land title records. The Recreation Commission was given increased authority to meet the expanding problems of recreational activities throughout the Territory.

The Fourth Guam Legislature in January 1958 made appropriations for an administration building, a Territorial College plant, and a Power Sinking Fund. This Sinking Fund was made necessary to meet the commitments of the government of Guam for participation with the Navy in the construction of operating facilities to meet the future electric power needs of Guam. The administration building, in which work was started, will greatly improve the operation of the government by bringing the presently scattered offices of the executive branch into a single building. Construction work was started on five new school buildings and on an extension of telephone lines along the southern end of the island. A contract for a much needed new Post Office Building was awarded by the Federal Government.

Thirty-one laws passed by the Guam Legislature were approved by the Governor. Of major significance were: The exemption of certain taxes to facilitate contracts for military housing; the granting of franchise rights for public transportation; extension of free textbooks to all school children in Guam; safety inspection of vehicles; and provision giving jurisdiction to the District Court of Guam with respect to income tax appeals.

An improvement in the economy of the Territory was shown by the fact that retail sales, private and commercial building, bank clearances, and tonnage port receipts for the year were better than last year. Supervision of the Commercial Port by a consulting firm was placed under a new contract at a saving to the Territory. The Guam Employment Office was opened under the regulations of the United States Employment Service.

A continuing 6-year budget and planning program was instituted which will enable the Legislature and the Governor to anticipate most of the future needs of the Territory from a fiscal standpoint.

AMERICAN SAMOA

The political and economic advancement of American Samoa, in accordance with the desires and capabilities of its people, continues to be of primary concern in the administration of the Territory.

Improvements to the economy during the year resulted from increased production and employment at the tuna cannery at a level of 350-400 people. The increased numbers of cruise vessels visiting the area provided a wider outlet for handicraft products, as well as creating income from services provided the vessels, their crews, and passengers. Similar benefits came from more frequent stops of Naval vessels due to improvements in the docks and fueling facilities. The groundwork for a long-range agricultural program was introduced and the importance of producing subsistence agricultural crops stressed in visits by the Governor to all villages in the Territory.

Preliminary rough clearing of some 75 acres of the runway for the new airfield has been accomplished. This marks the first tangible step in the development of a modern international airport with a 9,000-foot runway which will be able to accommodate jet aircraft.

The newly formed Planning Commission was instrumental in developing a 6-year construction program and in considering long-range plans for reclaiming land, zoning, developing roads and, in general, planning to meet the problems of a rapidly growing population, urbanization, and the move of country people into an already overcrowded bay area.

The minimum wage rates applicable to American Samoa under the Fair Labor Standards Act were reviewed during the fiscal year. The following minimum wage rates adopted by the United States Department of Labor for the Territory: fish canning and processing industry, 52 cents per hour; petroleum marketing industry, 52 cents per hour; shipping and transportation industry, 50 cents per hour; and miscellaneous industries, 38 cents per hour. These new rates show a substantial increase in the earning power of the Samoans and represent a 14-cent-an-hour increase in some industries.

Education in Samoa continues to be a joint undertaking between the government and the villages, especially on the village level. The dedication of the Governor Coleman Elementary School in Pago Pago in February 1958, marked an outstanding example of the initiative of a village people in financing and constructing a permanent 2-story building from their own resources. Other villages are devoting a considerable part of their collective efforts as communities in improving their school facilities.

Six members of the Legislature of American Samoa and one legislative staff member visited New Zealand and Fiji as a part of a program of indoctrinating the Legislature in a better understanding of the governmental processes in other areas.

Early in the year, the Department of Medical Services was reorganized for more effective administration and was placed under the

rection of a medical doctor who has his master's degree in tropical public health. Under his direction, emphasis has been given to public health programs on a village level. These programs include aid to the villages in improving their water supplies and health centers, a general health survey which will eventually embrace all school children in the Territory, dental examinations of school children and pre-natal and well-baby clinics. Public health teams have been visiting the public schools and giving the students physical examinations and inoculations against diphtheria, whooping cough, tetanus, smallpox, and poliomyelitis. A 5 year filariasis eradication program is being formulated. At the hospital, both inpatient and outpatient loads increased substantially, indicating greater use of the medical services available.

As a step toward a youth development and physical fitness program, a youth officer for the Territory was appointed and encouragement given to the formulation of athletic teams and competition.

THE VIRGIN ISLANDS

Considerable strides were made in achieving stability in the Government of the Virgin Islands during fiscal year 1958. Most noteworthy is the fact that the new 5-volume Virgin Islands Code of Laws became effective on September 1, 1957. The Office of the Government Secretary expanded its operations in accordance with provisions of the code.

Total revenues collected amounted to \$4,393,742.60, representing an increase of \$542,001.10, or 14.07 percent over fiscal year 1957 collections. The cash balance in the General Fund on June 30, 1958 amounted to \$1,585,767.83. General Ledgers for all funds were set up and will make available for the first time a balance sheet showing the full financial status of the Territory. An Internal Audit Section was established.

In the Department of Tourism and Trade, over 200,000 pieces of Virgin Islands literature were distributed to airline, steamship, travel agencies, and individuals. The department promoted and participated in programs which resulted in numerous substantial groups consisting of travel, industrial and recreational organizations visiting the Virgin Islands. Eighty-six cruise ship visits surpassed all records. Ports again produced a record-breaking year of tourist income.

As has been true for the past 2 fiscal years, the St. Thomas water supply has received the principal attention of the Department of Public Works. As a result of unexpected rainfall in the spring of 1958, following the drought of 1957, the water haul by barge from Puerto Rico was discontinued early in the month of May for the balance

of the fiscal year. In St. Thomas, 45.48 inches of rain fell as compared with 27.76 inches last fiscal year.

In St. Thomas, 441 ships over 100 tons entered the port with a gross tonnage of 3 million tons. Legislation was passed to authorize negotiations for the sale of the telephone system.

Public school enrollment of 6,080 was distributed among 10 schools in St. Thomas (3,545), 4 in St. John (219), and 8 in St. Croix (2,316). There were 312 children in public kindergartens. Parochial and private schools enrolled 1,040 in St. Thomas and 1,209 in St. Croix. A Commissioner of Education was appointed in March 1958. The Virgin Islands Plan for the Extension of Library Services to Rural Areas was approved, and \$20,641 in Federal funds became available for this purpose.

The Department of Health has been reorganized into three Divisions, namely: Hospital and Medical Services, Public Health Service and Veterinary Medicine. The Virgin Islands State and Survey Plan for construction of hospitals and medical facilities under the Hill-Burton Act was completed. The Hansen's Home in St. Croix was closed, and social readjustment of patients was made with the assistance of the Department of Social Welfare. The testing of all cattle for detection of brucellosis was completed. All reactors were destroyed and their owners compensated.

In the principal programs of the Department of Social Welfare, Public Assistance aided a caseload ranging from 1,963 persons in September 1957 to 1,664 persons in June 1958. The Child Welfare caseload averaged monthly 135 children in foster homes and 38 boys and 6 girls in the Training Schools. Otherwise, 454 children received casework services.

Among improvements realized by the Department of Public Safety were the establishment of crosswalks at busy sections of the townships, motorized patrols of the new highway; and the placing of traffic control signs. Funds were appropriated for the purchase of new trucks which will be delivered early in the new fiscal year.

According to provisions of the Virgin Islands Code, the Department of Property and Procurement was organized during fiscal year 1958, with the appointment of a Commissioner and approval of an Organizational Chart by the Governor. Proper directives were issued outlining functions of the various divisions.

To date, 41 industries have been granted tax exemption. During the fiscal year 1958 the amount of \$683,730.29 was paid in subsidies extending over a 4-year period to 20 claimants.

VIRGIN ISLANDS CORPORATION

The major activities of the Virgin Islands Corporation continued to be the growing of sugarcane, the production of raw sugar, the generation and distribution of electric power, and various agricultural development projects.

The drought in the summer of 1957 was the worst in the last 70 years and seriously curtailed agricultural production. As a result, the sugarcane crop for 1958 was one of the smallest in the history of the Virgin Islands. A total of 63,277 tons of sugarcane were bound and 5,982 tons of raw sugar were manufactured, as compared with nearly 15,000 tons last year. This substantial reduction in production resulted in a loss in the sugar operations of \$676,137.

The installation of facilities for the handling of bulk sugar resulted in substantial savings in handling and shipping costs. It was estimated that such savings amounted to more than \$50,000. A completely new innovation was utilized in the handling of our bulk sugar; a sealed rubber bag, holding approximately 1½ tons of sugar, was used for transporting the raw sugar from the warehouse to the ship.

The operations of the Power Department continued to be highly successful and the consumption of electric power increased another 10 percent. Power operations showed a profit of \$133,878 for the year.

The agricultural programs of the Corporation were concerned primarily with the construction of dams and with land clearance. A total of 10 dams with an estimated capacity of 9 million gallons were completed. The value of the dam construction program was definitely established during the long drought period, and due to the availability of stored water, many more animals survived than would otherwise have been possible. Some 500 acres of brush land were cleared for cultivation. The forestry program was active throughout the year and substantial plantings of mahogany and teak were made on both private and Government lands.

Office of the Assistant Secretary

Fish and Wildlife

Ross Leffler, *Assistant Secretary*



THE ASSISTANT SECRETARY for Fish and Wildlife discharges the duties of the Secretary of the Interior with respect to the Department's programs in the field of fish and wildlife. He is responsible for the secretarial direction of the United States Fish and Wildlife Service and its constituent bureaus.

The issuance of oil and gas leasing regulations and stipulations on wildlife lands, the decision to ask the Congress for a \$3 duck stamp with all the revenue earmarked for wildlife land acquisition, the application for withdrawal of 9 million acres of land for the proposed Arctic Wildlife Range, efforts to help the groundfish industry and tuna fishery solve their problems and activities concerning the future of the American red salmon were among the many things which highlighted fiscal 1958.

Other events of importance included:

The accord reached by the United States Fish and Wildlife Service, the States, and the other interested Federal agencies on the proposed amendments to the Coordination Act;

The proposed comprehensive research program on pesticides and their application;

The inauguration of fishing vessel safety studies;

The recognition of the need of more scientific information about tidal marshes and the estuaries;

The impetus given wildlife research to devise management practices that can be employed by farmers and managers of forests and range lands in developing the multipurpose concept of conservation;

The initiation of a long-range program to help States maintain sport fishing in future years by (a) establishing a fisheries management service to aid in maintaining the productivity of fishing areas.

already established, and to establish new areas on Federal properties, (b) to continue and intensify the research on disease, diet, relation of fish to the environment, and (c) a program of construction, expansion, and maintenance of hatcheries;

Ratification of the new fur seal convention between the United States, Canada, Japan and the U. S. S. R.;

The establishment of a Branch of Columbia River Fisheries to coordinate a variety of programs relative to that fishery;

Impetus to research to assure the consumer the best possible fishery product;

Continuation of numerous studies relative to utilization of fishery products;

A change in the acquisition policy of the Migratory Bird Conservation Commission which will facilitate the acquisition process;

The addition of four important new refuges to the Federal Wildlife Refuge system and the addition of areas to already established refuges;

Transfer to the Department of the Interior of several fishery matters such as inspection, transportation studies and other matters on the Department of Agriculture and the Department of Commerce.

Inauguration or the continuance of numerous economic studies of value to the fishing industry;

The request by many States for new definitions in the formula for distributing Federal-aid money;

Settlement of issues relative to military use of part of the Wichita Mountains National Wildlife Refuge; the Kodiak bear-cattle problem; freshening the Topock marsh along the Colorado River; and the land-use question at the Klamath-Tule marsh;

The inauguration of a comprehensive research program on fish culture in rice fields.

Other developments which could be mentioned are the banning of use of electronic waterfowl calls, the curtailment of salmon snagging, the efforts to get protection for the polar bear and walrus on the seas, the continued progress in the fight against the sea lamprey in the Great Lakes, continued improvements in electrical guidance equipment, full scale tryouts of fish-protective devices begun at McNee Dam on the Snake River and numerous achievements in laboratory fishing and fishery biological and oceanographic operations.

The Bureau of Commercial Fisheries has made or is making numerous studies relative to the plight of the New England groundfish industry. These studies include market development possibilities, the relationships of the groundfish industry to the general economy of the area, various technological demonstrations on such things as stor-

ing and icing practices, insurance studies, inauguration of safety programs, equipment demonstrations, as well as rendering technical aid and information in the drawing of legislation designed to meet some of the problems.

The Bureau also compiled during the year a comprehensive economic study of the tuna fishery in relation to imports and exports. This study was made at the request of several segments of the fishery and consisted of a factual resume which was filed with the President and the Congress. Research on the Long Island oyster plight and on other shellfish problems are in process.

Attention of the people of the country was called to the condition of the red salmon fishery of Alaska, one of the Nation's more important fishery. Studies which have been progressing over the past years are beginning to unfold the pattern of the migrations of the Asian and American races of salmon and the effect of pelagic fishing upon the supply. Studies during the year indicated that the future of the big Bristol Bay red salmon fishery was threatened by pelagic fishing beyond the control of the Fish and Wildlife Service and the Department of the Interior. Additional data are being gathered as part of the three-nation study (Japan, Canada, and the United States) of the migrations of the Asian and American salmon.

The issuance of oil and gas leasing regulations and stipulations by the Secretary of the Interior ended a long controversy, with the wildlife values of the various refuges and game ranges protected, but developments permitted in certain places under certain rigid conditions. Under the regulations, oil leasing is prohibited on all refuges in continental United States except when drainage by outside operations threatens serious loss of potential public revenues. Leasing of game ranges in continental United States and on all Federal wildlife areas in Alaska will be permitted only on areas determined to be essential for the welfare of the species for which the range or refuge was established. The Secretary of the Interior—upon information developed by field studies made by the Bureau of Sport Fisheries and Wildlife, the Bureau of Land Management, and the Geological Survey—may designate on which parts of the ranges leasing will be permitted. Such leasing is then done in accordance with stipulations which further protect the wildlife resource.

The recommendations regarding the \$3 duck stamp and the earmarking of the funds will have two effects—accumulating about \$6,000,000 per year from the duck hunters for acquisition, and making necessary funds from general appropriations to replace the duck stamp money which previously has been directed toward refuge management and law enforcement.

While the additional revenue will speed up the acquisition program, it will still be many decades before the necessary land can be purchased and developed for waterfowl areas. Withdrawal of additional Federal lands and retaining the waterfowl values on private lands are two of the ways that waterfowl habitat needs could be partially met. The Arctic Wildlife Range, when officially created, will be by far the Nation's largest wildlife area. The area is in the northeastern corner of Alaska. It borders on Canada and on the Arctic Ocean and extends 140 miles from north to south and 120 miles from east to west. The Secretary of the Interior has withdrawn this huge area from all types of entry pending final action.

The Coordination Act, amended as the Department recommended, will greatly improve the status of fish and wildlife resources in water and watershed developments.

FISH AND WILDLIFE SERVICE

Arnie J. Suomela, *Commissioner of Fish and Wildlife*



ACTIVITIES of the United States Fish and Wildlife Service can be considered in four categories—those concerning an important natural resource, those relating to essential recreational resources, those important to resource use for commercial or aesthetic reasons, and those which are common to both commercial and recreational values.

Those activities are discussed, although not in those specific classifications, in the appended reports of the Service's two component bureaus—the Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries—and some basic principles about these programs in general is pertinent to full understanding of these activities devoted to perpetuation and wise use of a vital national resource.

While the activities of one bureau are labeled "commercial" there are many ways in which that particular bureau works in the interest of recreation as well as the health and food needs of Americans. To give one example—there is the research work done for commercial reasons on channel catfish which developed information now being used in improved fish cultural operations involving this species in sport fish hatcheries.

Some work being done by the sport end of the organization is extremely commercial in that it is helping solve problems of reforestation and other uses of land. Also work which is being done in the interests of fish and game is the basis for some programs which are saving livestock from predators and other work which may save important commercial fishery spawning grounds from ruinatic pesticides.

Thus, while it might appear on the surface that there is a wide gap between the interests of the inland hunter and the man who makes his living by casting his net into the sea, there are many places where these interests coincide.

One such case concerns the Nation's tidal marshes and the estuaries which provide important spawning grounds for commercial fish.

entering areas for migratory waterfowl. Another field of joint interest lies in river developments which so many times adversely affect the interests of the sport fisherman and the commercial fisherman and which too often affects resident or migratory wildlife.

The pesticide problem is becoming acute. Although the initial impact was most evident on sport fish and wildlife, its possible effect on commercial fisheries is readily apparent. The danger to commercial fisheries is particularly noticeable where housing developments have been established on "reclaimed" tidal flats or near them and where the "mosquito menace" can lead to indiscriminate use of pesticides. Research done by some State agencies and the Bureau of Sport Fisheries and Wildlife has shown that under certain conditions mosquitoes can be controlled and the duck marsh improved at the same time. This pattern indicates that it might be possible to control mosquitoes and to injure spawning areas but this is a matter which will require considerably more research.

The sea lamprey is a menace to commercial fishing in the Great Lakes and the work which is being done to control and possibly eradicate it from the lakes will redound to the benefit of the important sport fisheries in those waters. Work done on electrical and other devices to drive fish with commercial values away from such danger points as pipeline intakes and irrigation outlets is of inestimable value to sport fisheries and when these techniques are perfected they will become valuable to those recreational fisheries.

Siltation control on watersheds can conceivably react to the benefit of shellfish which live in the estuary and which might otherwise be smothered over, or spawning areas for commercially important fish might be silted from siltation at critical times. Thus, research work being done by some Service employees to protect tree seeds and seedlings from insects and rodents may in the long run benefit shellfish and finfish production a thousand miles away.

There are scores and scores of examples showing that the goals of the Bureau of Sport Fisheries and Wildlife and those of the Bureau of Commercial Fisheries are similar in many instances, and other examples as well which show that the work of one Bureau helps the other solve a problem or meet an issue.

As time goes on, and as population not only pinches wildlife habitat and land but crowds to the very waters' edge to threaten some of the resources of the sea, the problems which these two arms of a great conservation program have in common will become more evident and combined efforts to fit the Nation's fish and wildlife resources into a crowded world more apparent.

INTERNATIONAL RELATIONS

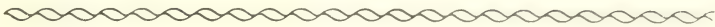
The most significant event of the year, internationally, was the United Nations Conference on the Law of the Sea, which convened in Geneva on February 24, 1958, and continued its deliberations until early May. Four Conventions were drafted and opened for signature by the 86-nation Conference. The most important of these in terms of conservation is the Convention on Fishing and Conservation of the Living Resources of the High Seas. For the first time, broad agreement has been reached on a system of rules to guide nations in the orderly and harmonious development and conservation of the resources of the sea.

The Fish and Wildlife Service continued to assist the International Cooperation Administration in a program of technical assistance to friendly foreign nations. In the past year, fishery technicians were assigned to the following countries: Bolivia, Peru, Liberia, Tunisia, Italian Somaliland, Pakistan, India, Indonesia, Viet Nam, Cambodia, Taiwan, and Korea. Technical training in the United States was provided for 26 foreign students and administrators, who are now prepared to assume enlarged responsibilities in their home countries.

The several international fishery commissions continued their investigatory and regulatory activities. The year witnessed the meeting of the North Pacific Fur Seal Commission, the newest organization of this sort of which the United States is a member. It also saw the negotiation of a Convention between the United States and Cuba for the conservation of the important shrimp resources in the eastern Gulf of Mexico. At the end of the year, this Convention awaited signature.

BUREAU OF SPORT FISHERIES AND WILDLIFE

Daniel H. Janzen, *Director*



NATIONAL WILDLIFE REFUGES

ACQUISITION of new refuges, expansion of several established ones, and safeguarding of all, highlighted progress in the protection of wildlife during the fiscal year 1958.

Four new refuges were established. Holla Bend National Wildlife Refuge, a potentially great waterfowl area in Arkansas, was acquired in August 1957. A shield-shaped island of 4,068 acres in the Arkansas River, about halfway between Little Rock and Fort Smith, this refuge will be developed as a wintering ground for ducks and Canada geese. Horn Island National Wildlife Refuge, in Mississippi, was acquired in May 1958. Its 2,484 acres comprise about two-thirds of a sand and marsh island some 8 miles off shore in the Gulf of Mexico. Oak Orchard National Wildlife Refuge, in northwestern New York, was established in May 1958. Here, about 10,000 acres of swamplands will be developed for Atlantic flyway waterfowl. Klamath Marsh National Wildlife Refuge, established in June 1958, will preserve some 24,000 acres in the upper part of the Klamath basin in Oregon.

The Migratory Bird Conservation Commission approved acquisition of seven additional National Wildlife Refuges. The 7,000-acre Soto Refuge in Nebraska and Iowa, about 15 miles north of Omaha, was approved in March 1958. It will be a combination National Wildlife Refuge and recreation center, and will fill a long-recognized need for a resting and feeding place for migratory waterfowl, particularly Canada geese, in this area. Erie National Wildlife Refuge, approved in March 1958, will contain a little over 6,000 acres about 35 miles south of Erie, Pa., and will be the first Federal refuge in Pennsylvania. The Commission also approved in March

1958 the acquisition of 10,240 acres in Kern County, Calif., about 40 miles northeast of Bakersfield, to supply much-needed wintering area for ducks and geese in that part of the Pacific flyway.

The Day County Production Area, 2,993 acres in northeastern South Dakota, was approved in June 1958 for purchase as a demonstration production area for waterfowl. This area represents as nearly as possible "typical pothole country" as found in parts of North and South Dakota and Minnesota. Also approved in June 1958 were the 17,872-acre Fish Springs Refuge in Juab County, Utah; the 1,500-acre Swan Island Refuge in the Merrymeeting Bay area in southern Maine; and the 1,089-acre Troy Meadows Refuge in Morris County, N. J.

On April 18, 1958, the Secretary of the Interior announced the new stipulations governing oil and gas leasing on United States wildlife lands. Leasing is now prohibited on all wildlife refuges in the continental United States except where necessary to prevent drainage from drilling in adjacent non-Federal areas. On the other wildlife lands—game ranges, Alaskan wildlife areas, and Federal State cooperative lands—drilling and leasing will be permitted only when there is no interference with wildlife conservation.

On 242 National Wildlife Refuges, with about 41½ million acres for waterfowl, colonial birds, and rare and vanishing species, oil and gas leasing is prohibited except for peripheral drilling under certain circumstances. Five Game Ranges in the United States, with 4½ million acres, may have leases granted subject to stipulations designed to minimize disturbance and damage to wildlife habitat. Refuges and game ranges in Alaska will be treated the same as game range lands in the States.

The Wichita Mountains Wildlife Refuge land issue was concluded on September 6, 1957, when the Under Secretary of the Army approved an agreement with the Assistant Secretary of the Interior for Fish and Wildlife, providing for the Army's use of some additional refuge lands and relocation of recreation areas affected.

The threat to bisect the Crab Orchard National Wildlife Refuge in southern Illinois by a limited-access highway was partially averted through an agreement to relocate the highway closer to the east boundary of the refuge.

Protection for the tiny key deer was advanced through legislation passed at the first session of the 85th Congress. This made possible the establishment of a National Key Deer Refuge of not to exceed 1,000 acres. Rapid development of the Florida Keys threatens such a drastic change in environment that the deer are believed to be doomed unless some haven is provided. Early in 1958, the first parcel of land for the refuge was donated to the Department of the Interior.

the North American Wildlife Foundation. This gift of 151½ acres is especially valuable because it provides one of the few boat basins in the key-deer area. This gift of land also provides a suitable headquarters site and facilitates protection of the birds of the Great White Heron Refuge, a few miles to the north.

In 1956, representatives of the United States Fish and Wildlife Service and the Bureau of Land Management conducted a joint field study for the purpose of resolving the conflict between livestock and wildlife interests on the Kodiak National Wildlife Refuge in Alaska. That study resulted in a proposal to redraw the refuge boundary line to provide for some enlargement of the grazing area on the Chiniak Peninsula of Kodiak Island and to close the 1-mile strip to grazing and other nonconforming uses. The Service proposed that there be a buffer zone of 1 square mile established around the existing villages within the 1-mile strip which would provide sufficient land to meet foreseeable needs of the community.

Early in 1958, the Secretary of the Interior approved a Public Land Order along those lines, reclassifying lands within the Kodiak National Wildlife Refuge in order to safeguard valuable habitat and to exclude some lands suitable for the grazing of cattle.

More than 8½ million visitors were on the National Wildlife Refuges in 1957 to see the millions of birds and animals, and to enjoy other forms of recreation. These 8,668,580 visitors represent a 14.6 percent

increase in the Klamath Basin are of great importance to waterfowl of the Pacific flyway.



increase over 1956, when 7,555,334 visitors were present. Almost third, or 2,908,435, used the refuges for fishing. Public hunting amounted to 4½ percent, or 388,995 visitor-days. Wildlife observations, picnicking, and swimming, together with business and official use, amounted to 5,371,150, or more than 62 percent of all uses. Recreation is permitted on designated portions of refuges where such coordinated use can be accomplished without defeating the primary objectives for which the refuges were established.

Acres acquired or in process of acquisition by U. S. Fish and Wildlife Service for wildlife conservation purposes

| State and refuge ¹ | Acquired in fiscal year 1958 | | | Pending title conveyance |
|---|------------------------------|-------------|--------|--------------------------|
| | By other than purchase | By purchase | Total | |
| Arkansas: | | | | |
| Big Lake..... | | | | 2 |
| Holla Bend..... | 4,068 | | 4,068 | |
| California: Kern..... | | | | 10.2 |
| Colorado: Monte Vista..... | | 2,601 | 2,601 | 1.4 |
| Florida: National Key Deer Refuge..... | 16 | | 16 | |
| Georgia: Okefenokee..... | | 1,799 | 1,799 | |
| Idaho: Deer Flat..... | 120 | | 120 | |
| Kansas: Quivira..... | | 1,897 | 1,897 | 3.3 |
| Kentucky: | | | | |
| Kentucky Woodlands..... | | 236 | 236 | |
| Reelfoot..... | | 84 | 84 | 1 |
| Louisiana: Catahoula..... | | | | 5.1 |
| Maryland: Martin..... | | | | 1.3 |
| Massachusetts: Great Meadows..... | | | | |
| Michigan: Shiawassee..... | | 585 | 585 | |
| Minnesota: | | | | |
| Rice Lake..... | 56 | | 56 | |
| Tamarac..... | 3,348 | 387 | 3,735 | 1.0 |
| Upper Mississippi River Wild Life and Fish Refuge..... | | | | 3 |
| Mississippi: | | | | |
| Horn Island..... | 2,484 | | 2,484 | |
| Noxubee..... | | 125 | 125 | 1 |
| Petit Bois..... | 153 | | 153 | |
| Montana: Benton Lake..... | | 148 | 148 | |
| New Jersey: Brigantine..... | | | | |
| New York: | | | | |
| Montezuma..... | | | | 1 |
| Oak Orchard..... | | 123 | 123 | 1.7 |
| North Dakota: | | | | |
| Chase Lake..... | | 3,660 | 3,660 | 6 |
| Lake Ho..... | | | | 9 |
| Long Lake..... | | 160 | 160 | |
| Shell Lake..... | | | | 1 |
| Tewaukon..... | | 1 | 1 | 1 |
| Oregon: | | | | |
| Klamath Marsh..... | | | | 5.0 |
| Malheur..... | 13,758 | | 13,758 | 1.2 |
| McKay Creek..... | | | | |
| Upper Klamath..... | 6 | | 6 | |
| Pennsylvania: Erie..... | | | | 1 |
| South Carolina: Santee..... | | | | 3.0 |
| Tennessee: Tennessee..... | 2,609 | | 2,609 | |
| Texas: Laguna Atascosa..... | | 18 | 18 | |
| Vermont: Missisquoi..... | | 11 | 11 | |
| Virginia: Chincoateague..... | | 1 | 1 | |
| Washington: Columbia..... | | 78 | 78 | 1.3 |
| Wisconsin: Upper Mississippi River Wild Life and Fish Refuge..... | | | | |
| Wyoming: National Elk Refuge..... | | | | 1 |
| Total..... | 26,618 | 11,914 | 38,532 | 34.0 |

¹ Name includes "National Wildlife Refuge" except as indicated.

*acreage of publicly owned land reserved for wildlife conservation purposes
and administered by the States*

State and unit:

| | |
|--|--------------|
| California: | <i>Acres</i> |
| Honey Lake Waterfowl Management Area----- | 185 |
| Tower House Springs Upland Game Management Area----- | 570 |
| Wyoming: Ocean Lake Game and Fish Management Unit----- | 10, 114 |
| Total ----- | 10, 869 |

MANAGEMENT AND ENFORCEMENT

The human population of North America steadily increases, and the demand continues to grow for more land, water, and food. The degree to which waterfowl and waterfowl hunting survive in the face of increasingly intensive land use depends largely upon how wisely game administrators use three tools: (1) Investigation, to learn more about waterfowl, their needs and their relations and reactions to changing conditions; (2) education, to achieve a widespread understanding of, and support for, necessary game-management practices; and (3) public acceptance and observance of protective measures promulgated to assure the perpetuation and wise use of the continent's waterfowl resources.

To obtain facts, the Bureau again engaged in a cooperative fact-finding program in which representatives of the Bureau were teamed with personnel of 15 States, Canadian Dominion and Provincial Game Departments, and Ducks Unlimited, in key waterfowl-production areas in the United States and Canada. This year's program resulted in the banding of a greater number of waterfowl than ever before and the gathering of a considerable quantity of data of benefit in the future to the proper management of waterfowl continent-wide.

The Bureau maintained close relations with the States in providing protection to migratory game birds, and United States Game Management Agents reciprocated for the assistance received from State wardens by helping them in the enforcement of State laws for the protection of resident species of wildlife.

Working with the various States, agents of this Bureau assisted in the apprehension of 4,238 violators of State laws and regulations for protection of game and fish. Of these violations, 2,200 involved unlawful taking or possession of migratory game birds, and 16 related to unlawful interstate transportation of game or fish. Total fines in the State actions were \$115,207.55, of which \$11,681.50 were suspended; a total of 4,321 days in jail were assessed, of which 2,001 days were suspended.

During the period July 1, 1957, to June 30, 1958, 348 cases involving violations of the Alaska Game Law were processed. Eight of these were also violations of the Migratory Bird Treaty Act regulations but were settled under the Alaska Game Law regulations. In addition, four violations of the Migratory Bird Treaty Act were processed under that act, and one violation of the Migratory Bird Hunting Stamp Act was terminated. Eight violations of the Alaska Territorial Wanton Waste Act were handled.

On these 361 cases, 303 were found guilty, 35 were terminated by forfeiture of weapons or game, etc., 9 were dismissed, 2 were acquitted, and 12 were pending at the close of this period. For these convictions, the total fines were \$28,895, and the jail sentences were 2,808 days. Of these, \$5,969 and 2,701 days were suspended.

Table of cases disposed of in Federal courts (exclusive of Alaska) involving violations of wildlife conservation laws which were administered by the Bureau of Sport Fisheries and Wildlife during fiscal year 1958

| | Pending July 1, 1957 | New cases | Pending June 30, 1958 | Terminated | Fines and costs | Jail sentences (days) |
|---------------------------------------|----------------------------|--------------|-----------------------------|------------|--------------------|--------------------------|
| Migratory Bird Treaty Act..... | 417 | 1, 147 | 657 | 907 | \$33, 555. 00 | 2, 000 |
| Migratory Bird Conservation Act..... | 24 | 162 | 54 | 132 | 4, 920. 00 | 20 |
| Migratory Bird Hunting Stamp Act..... | 14 | 91 | 13 | 92 | 1, 643. 00 | |
| Lacey Act..... | | 15 | | 15 | 684. 00 | |
| Black Bass Act..... | 2 | 11 | | 13 | 2, 850. 00 | |
| Bald Eagle Act..... | 2 | 4 | 3 | 3 | 194. 50 | |
| Halibut Act..... | 2 | | | 2 | 200. 00 | |
| Assault Act..... | 2 | 1 | 2 | 1 | | |
| Northwest Atlantic Fisheries Act..... | | 1 | 1 | 1 | 100. 00 | |
| Upper Mississippi Refuge Act..... | | 2 | 1 | 1 | 35. 00 | |
| Sockeye Salmon Act..... | 1 | | | 1 | | |
| Total..... | 464 | 1, 434 | 730 | 1, 168 | 43, 981. 50 | 2, 220 |

¹ Includes 100 cases on which prosecution was declined, 61 actions dismissed, 36 acquitted, and 2 cases transferred to State court, and 1 Sockeye Salmon case turned over to Bureau of Commercial Fisheries with assumed responsibility for that act.

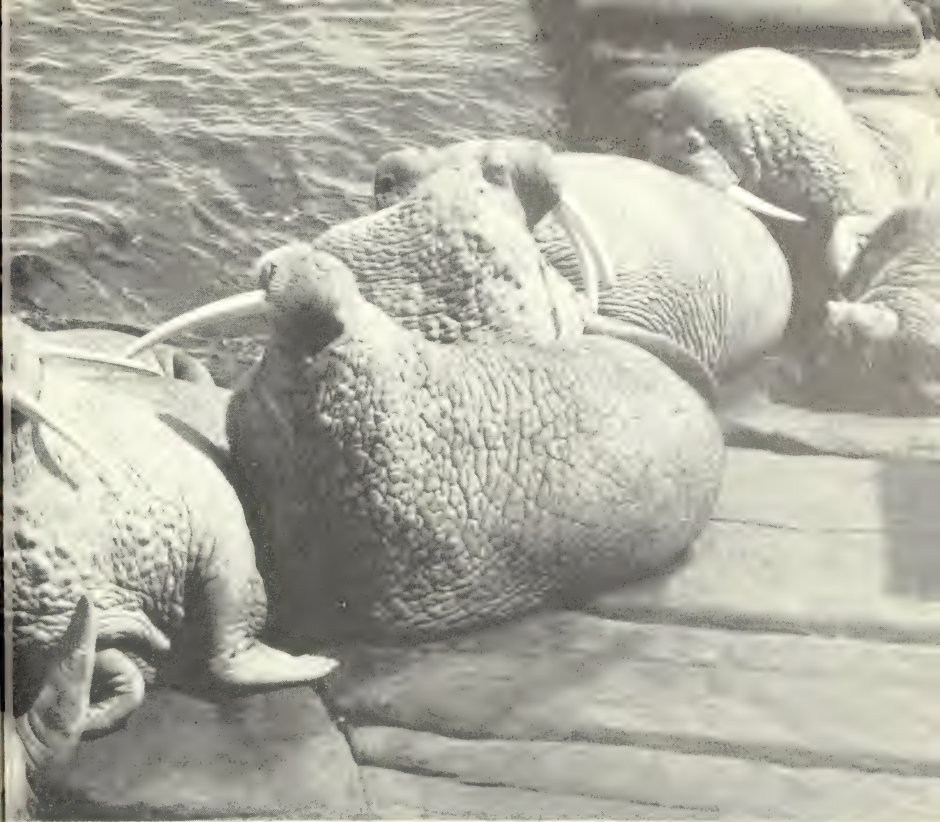
² Includes \$2,741 suspended.

³ Includes 1,986 days suspended.

WILDLIFE RESEARCH

Wildlife-research activities of the Bureau are centered in the Branch of Wildlife Research. The research is carried out through the Denver and Patuxent Wildlife Research Laboratories, Bird and Mammal Laboratories maintained in the United States National Museum, 16 Cooperative Wildlife Research Units located at land grant colleges and universities in 15 States and Alaska, and through contracts with universities and other institutions.

The Branch not only investigates wildlife-management problems faced by the United States Fish and Wildlife Service but also conducts research of value to other land-managing agencies within the Department of the Interior and to other Federal and State conser-



Walrus on the only hauling ground regularly used in United States waters.

ion agencies. It serves as a source of wildlife knowledge for the public, helps maintain extensive collections of birds and mammals at the National Museum, and operates a bird-banding and records center at the Patuxent Research Refuge.

Other services include analysis of animal specimens suspected of having been poisoned through control activities, testing of chemicals for assistance in the development of Federal specifications for rodenticides, and identification of plant and animal specimens for individuals or institutions. The training of professional conservation personnel is facilitated through the Cooperative Wildlife Research Program. By the end of the 1957 school year more than 700 students majoring in fish and wildlife management had graduated from Unit schools. By pooling manpower, equipment, and other resources, and working toward common objectives, the cooperating public and private agencies (Bureau of Sport Fisheries and Wildlife, Wildlife Management Institute, State fish and game departments, and land-grant colleges) have been able to accomplish much research at relatively low cost and promote conservation in

other ways. By the end of 1957 more than 2,766 publications summarizing research results had issued from these Cooperative Units.

During the past year considerable emphasis was placed on strengthening the research program through staffing and reorganizing the Branch. The major research efforts were directed toward developing improved management measures for migratory game birds, more effective methods for controlling depredating or nuisance birds and mammals, and a better understanding of pesticide-wildlife relations. Increased attention was given also to the polar bear, Pacific walrus, and sea otter. Polar bears are now being taken through use of aircraft up to 200 miles from the Alaskan coast. There is some indication that the Pacific walrus is being harvested in numbers exceeding its rate of reproduction. The sea otter is extending its range after near extinction and may again become a resource of economic importance.

Research on upland wildlife included studies to devise wildlife management practices that can be employed by farmers and managers of extensive forests and rangelands in developing the multiple use concept of conservation. Studies showed that herbicides such as 2,4-D and 2,4,5-T when used on mountain maple in the Lake States under prescribed conditions will kill the larger stems out of reach of deer and induce basal sprout growth available to deer; when used to rid southern forests of broad-leaved trees and shrubs to increase the production of pine timber, however, they may be detrimental to wildlife through elimination of valuable food and cover. Research is needed to more thoroughly evaluate various forest and range management practices in relation to wildlife production and to develop guidelines to safeguard wildlife resources in man's use and exploitation of the land.

Migratory game bird research included studies of waterfowl habitat to determine factors governing the productivity of areas and to learn how to make the best use of areas that are now left, and how to create new areas on sites not being utilized by man; projects dealing with population numbers and distribution in relation to hunting; and work on migratory-bird diseases.

Work on two major publications, one dealing with the Nation's marshlands and one with the identification of seeds used as food by waterfowl and other wildlife, was nearing completion at the end of the year. Successful, practical means of combating with chemical pesticides certain plants which lower the value of many marshes for waterfowl were described in a recently issued bulletin. To compensate for the continued loss of valuable waterfowl habitat, experiments were conducted in improving or creating areas in regions of dark stained, acid waters through periodic lowering of water levels, use of

effluent from sewage-treatment plants, and construction of islands for nesting and resting. A cooperative study was initiated with Virginia and North Carolina to ascertain factors responsible for the continuing decline in waterfowl use of the Back Bay-Currituck Sound area. Another study was begun to determine the relative utilization by waterfowl of man-made versus natural water areas in North Dakota, South Dakota, and Montana.

More precise information was obtained on the distribution, migration, and kill of the mourning dove, and considerable progress was made in summarizing available information on the white-winged dove. Information on the populations, distribution, and hunting afforded by black ducks and by canvasbacks was brought together for publication, and a report was issued on the whistling swans in Chesapeake Bay, a primary wintering area. Taxonomic and distribution studies on sandhill cranes provided information for use in formulating migratory game bird regulations. Approximately 300,000 migratory game birds were banded last year in cooperation with State, Canadian, and private banders to obtain detailed information about bird populations, distribution, and migration. More than 42,000 band recoveries were reported.

Waterfowl specimens collected along the Coeur d'Alene River of Idaho, where heavy mortality was reported, were found to contain considerable amounts of heavy metals, apparently from mine-waste pollution. Specimens submitted from the Crab Orchard National Wildlife Refuge of Illinois contained large amounts of lead presumably ingested with food. Methods for the control and prevention of botulism outbreaks in waterfowl were studied by hospitalizing and treating affected birds, analyzing the role of aquatic invertebrates in the initiation and duration of the outbreaks, and developing techniques for detecting toxin-producing areas in the field. Other disease studies were concerned with fowl cholera in waterfowl; aspergillosis, a fungus infection especially significant in geese and swans during their northward migration; and trichomoniasis, a disease of mourning doves.

Development of methods for the control of depredating and nuisance birds and mammals is an important function of the Branch. Research on blackbirds which cause extensive damage to corn, rice, and other crops, wild rodents of the forests and rangelands which deter forestation and consume large quantities of forage, commensal rats and mice which annually cause extensive damage to stored grain, processed foods, and other goods, and bird hazards to aircraft at Midway Island received particular attention.

In the Northwest, tree seed protectant formulas have been so successful that the forest industry is now reseeding vast areas where



Field corn damaged by redwinged blackbirds.

previously trees could not be established because the seeds were taken by rodents. Encouraging leads have been developed for pocket gopher control through manipulation of the vegetation on which they feed. Habitat modification, consisting in leveling sand dunes, revetments, and higher vegetation which deflect the air upward so as to provide favorable soaring conditions for albatrosses over runways proved to be the most practical approach yet discovered in reducing bird hazards to aircraft at Midway.

One of the major problems of the Bureau is that of appraising the effects on wildlife of use of pesticides, especially insecticides, on millions of acres of forest and agricultural land. During the year studies were made on wildlife hazards resulting from the imported fire-ant eradication program being conducted in the Southern States. Preliminary results indicate that the aerial applications of heptachlor and dieldrin in this program may cause severe losses of wildlife. Efforts are being made to develop guidelines and safeguards which will keep these losses to a minimum. As new chemicals are introduced and marketed they should be tested to determine their toxicity to wildlife and to learn the effects of sublethal dosages. Minute

quantities of those chemicals tested in the chlorinated-hydrocarbon group have been shown to reduce the reproductive success of quail and other wildlife. These findings pose new problems since damage may be considerably greater than would be indicated by dead animals found in the field following application of the pesticides.



Successful reseedling of vast logged and burned-over forest areas is now possible through use of seed-protectants developed by the Denver Wildlife Research Laboratory.

PREDATOR AND RODENT CONTROL

This year marks the 43d year of cooperation with agriculture, industry, and game-management agencies directed toward keeping predating, pest, and nuisance animals within limits compatible with human interests. Control operations were conducted under 59 cooperative agreements with 61 State agencies covering over 300 subsidiary agreements directed at specific animal control problems of local areas.

The bulk of the control of larger predators continued to be in the western half of the Nation. These coordinated projects encompassed both Federal and private lands. Controls were highly effective in preventing depredations on range livestock and game, or keeping losses within economically acceptable limits. The adaptable coyote continues to pose the principal control problem, and some local increases in population were evident. The bobcat population appears

to be leveling off, after several years of generally increasing abundance in the Western States. Perimeter control to protect highly vulnerable livestock from depredations by the larger predators is increasingly difficult on public lands. A variety of new human uses of these lands, most of them recreational, is sharply limiting the control methods which can safely be used. As a result the trend toward more extensive use of the steel trap continues—a slower operation requiring more manpower and therefore more expensive.

Wolves are abundant in most of Alaska with the exception of the lower Alaska Peninsula. Coyotes are on the increase and were taken in many new localities. Weather handicapped Alaskan control operations because of its mildness—aerial hunters lacked tracking snow in the interior, and low water in the summer changed the usual route of wolves and made canoe travel difficult. Wolf predation on reindeer ranging around Norton and Kotzebue Sounds was heavier than last year, but not extremely serious. The Alaskan wolf management study is now in its second year. During March and April 1 pack of 10 wolves was tracked several hundred miles and much was learned about predation on caribou and moose. Observations will be published when complete.

The Pacific Northwest will remember 1957-58 as the year of the meadow mouse. The most extensive meadow-mouse irruption on record reached a peak in November 1957 in parts of the agricultural areas of Washington, Idaho, Nevada, California, and Oregon, with damage heaviest in the Klamath Basin. Five Oregon counties alone reported loss of field and row crops in excess of \$5,000,000. The combined efforts of landowners, county, State, and Federal agencies used an estimated half million pounds of mouse bait as an immediate measure to protect valuable crops. Additional personnel were assigned to the affected areas, working with Agricultural, Public Health and other wildlife scientists. Control efforts were concentrated in critical crop areas, and control of the general mouse population was not attempted. Following the pattern of previous more severe but less extensive mouse irruptions, mouse numbers appeared to be approaching normal populations by mid-May, with a decline to below normal numbers reported in some areas.

Subsequent to the drought in most of the south central and southwestern districts, substantial changes in livestock management resulted in considerable revision and expansion of cooperative predator control projects. The improved forage conditions encouraged the increase of range rodents and jack rabbits but in less concentrated and less destructive abundance.

A team of two predator-control specialists from the New Mexico district conducted a 3-week demonstration of predator-control methods in Chihuahua, Mexico, at the request of the Pan American San

tary Bureau. An animal-control biologist from the Texas district assisted officials of the Government of Haiti for 4 weeks, establishing a rat-control program for the protection of the rice crop in the Artibonite Valley.

Predator-control programs in the western North Central States were extended to include small predators in farm areas of the eastern sections. Grain sanitation is a rapidly accelerating phase of rodent-control programs. Present-day sanitation standards have immediate economic ramifications for all segments of food-handling chains from producer to retailer.

The districts of the eastern half of the Nation emphasized the informational, educational, and demonstrational phases of animal control. In this area of heavy human population, animal-control problems are often locally severe but frequently so limited by a multiplicity of human interests that remedial measures remain largely the responsibility of the affected property owner. Where animal-control problems are of sufficient scope to be supported by associations or other groups with a common interest or by State agencies or political subdivisions, animal-control biologists provided technical supervision and guidance for the control program.

The heaviest impact of the Nation's mushrooming human population and expanding technology was felt in the eastern Predator and Rodent Control districts. The volume and variety of animal-control problems arising from competition between people and wildlife were unprecedented. This development must receive realistic recognition or risk effects detrimental to the whole cause of wildlife conservation. Requests for aid and advice on control measures received in one district were, for various animals: rats 12,828; various birds 11,674; moles 2,549; field mice 3,125; house mice 1,833; woodchucks 1,467; snakes 1,444; bats 1,340; muskrats 1,182; pocket gophers 1,170; ground squirrels 1,134; tree squirrels 1,097; skunks 1,014; chipmunks 858; weasels 637; opossums 632; rabbits 488; porcupines 241.

The reservoir of rabies in wildlife is of increasing concern, as people and their livestock come into closer contact with wild animals. Predator and Rodent Control districts of the Southeastern, Southern, Midwestern, and Southwestern States engaged in substantial cooperative projects to contain rabies outbreaks, principally in skunks, foxes, and raccoons. The rise in the incidence of rabies in Alaska received careful attention because of the high fox population in northwestern and southwestern Alaska.

The adverse effect of certain field rodents on reforestation still constitutes one of the most pressing nationwide rodent-control problems. Cooperative predator and rodent control operations were financed by \$1,922,959 of regular departmental appropriations, and \$1,563,814 from cooperating States, supplemented by \$1,461,629 from cooperat-

ing counties, livestock associations, cities, and others. The recorded catch of predatory animals was 62,765 coyotes, 2,787 wolves, 23,44 bobcats and lynx, 1,023 stock-killing bears, and 331 mountain lions. Cooperative rodent-control operations treated 1,355,368 acres of land for critical infestations of prairie dogs, ground squirrels, pocket gophers, jack rabbits, field mice, cotton rats, porcupines, and wood chucks. Some 10,559 premises were treated under cooperative rat control projects. Repellents, special equipment, and 643,625 pounds of rodent-bait materials were distributed by the Pocatello Supply Depot.

FEDERAL AID TO THE STATES

Activities of the Branch of Federal Aid were decentralized during the year. Authority to approve projects submitted by the States now rests in the five regional offices of the Bureau. The central office continues to make apportionments, makes management inspections of the original activities, compiles informational data, and provides staff service to the directorate. The central office staff has been reduced in size, and the regional office staffs have been standardized in their organizational pattern to achieve some nationwide uniformity of operation.

Fish Restoration

An apportionment of \$4,437,000 was made to the States and to Alaska, Hawaii, Guam, Puerto Rico, and the Virgin Islands during the fiscal year 1958.

Investigations on sport fishes were carried out in 161 projects in which the States obligated 45 percent of the funds available to them. In contrast to earlier years, there were fewer inventory or survey projects and more special research studies on definite problems, areas, or species. More effort was spent on the study of marine sport fishes than ever before, often in cooperative endeavors of several States. New techniques of fish management and harvest were created and evaluated, and study was given to the problem of handling masses of data by electronic means.

Development of new fishing waters and construction of access points on established lakes and streams were carried out on 134 projects, obligating 42 percent of all funds. Reclaiming of lakes and streams is being attempted on much larger bodies of water than before, as new toxicants become available.

Land continues to be bought for new lakes or for guaranteeing public access to fishing water. A total of 91 projects obligated 7 percent of available funds in 1958.

Less than 6 percent of the funds apportioned to the States was spent for overhead administrative purposes by the State organizations, a very commendable record as the States try their utmost to maintain good rates of catch for all fishermen in the face of rising fishing pressures and diminishing fishing opportunities.

Wildlife Restoration

An apportionment of \$17,100,000 was made to the States and Territories for the restoration and management of their wildlife resources during 1958.

A total of 200 projects obligated 24 percent of available funds for the purpose of collecting population trend data, reproductive success, and harvest information on the birds and animals of interest to hunters. The information was relied upon by all agencies as a basis for properly regulating the harvest, guaranteeing sound management, and insuring future hunting success.

The cooperative approach mentioned in earlier reports continues to gain momentum. State game departments are combining efforts and funds with other States, universities, Federal agencies, and foreign countries on special research projects into the nature of animal diseases, and into trap-and-transplant projects for big game and upland game birds.

A total of 327 projects obligated 54 percent of available funds on a variety of development projects designed to create or improve habitats for game animals, or provide access to game areas for the hunters. There is an apparent trend away from the planting of trees, shrubs, herbaceous crops as a single management tool, toward the more intensive manipulation of wildlife habitats. Not only is planting done, but also thinning or cutting, chemical control of the vegetation, and more detailed attention is given to the soil and its preparation. Construction of marshy impoundments continues for the benefit of waterfowl and furbearers, and at times for the benefit of sport fishes as well.

Land was acquired by 261 projects obligating 17 percent of all funds. A shift in emphasis is apparent, particularly in the Middle West, from purely developmental work toward purposeful acquisition of waterfowl-breeding areas and larger public hunting areas while these desirable acquisitions can still be made. Land thus brought under control will be managed later by the States for suitable wildlife species.

The record of maintaining low overhead expenses in administering the wildlife programs is even better than in the fisheries programs. A total of 48 projects obligated 4.5 percent of all funds available for this purpose.

FISH HATCHERIES

Recreational fishing of inland waters continued its steady increase throughout the Nation during the past year. Congress provided funds to begin construction of a new hatchery at Garrison Dam (North Dakota); to continue construction of new hatcheries at Cedar Bluff (Kansas), Gavins Point (South Dakota), Pisgah National Forest (North Carolina), Paint Bank (Virginia), Bowden Springs (West Virginia), and Miles City (Montana); and to continue improvement and expansion of facilities at 17 hatcheries. Construction of a new hatchery at Jackson (Wyoming) was continued with funds provided by the Bureau of Reclamation.

There was an increase of almost 60 percent in the number of fish applications received in the fiscal year 1958 as compared with the preceding fiscal year. Contributing to this increase were heavy rains in drought areas of the Southwest that filled many new ponds and refilled ponds that had become dry, restocking of waters from which undesirable fish had been eradicated, and increased interest in species previously propagated only in limited numbers.

In the calendar year 1957, the production, in pounds, of trout and salmon was about 8 percent greater than that of any previous year. The production of warm-water species was maintained at a high level, and special attention was given to increasing the production of channel catfish, walleye, pike, and redear sunfish, since these species are in great demand. Efforts were continued to improve the production of Atlantic salmon at the Craig Brook (Maine) station in conjunction with the Atlantic Salmon Restoration Program. With the assurance that the sea lamprey can be controlled in the Great Lakes, efforts are being made to build up stocks of lake trout brood fish to provide eggs and fingerlings for a restocking program.

Two important developments have placed a severe strain on State and Federal fish hatcheries. (1) Undesirable fish populations have been eradicated in many large reservoirs, lakes, and whole river systems, followed by restocking with desirable species. (2) A tremendous trout fishery has developed below many large dams, owing to change in water temperatures, and this fishery is dependent on restocking from hatcheries, since natural reproduction is extremely limited in these tailwaters.

A management-improvement project for development of fishery biologists and fish-hatchery managers was initiated during the year. This project includes training in fish nutrition, pathology, and hatchery production, and is an important development in the effort to promote sound use of our natural resources. In-service training schools were operated at Cortland, N. Y., Marion, Ala., Seattle, Wash., and Leetown, W. Va. This was the first year of operation for the Seattle and Leetown schools.

The table summarizes production and distribution of fish from Federal hatcheries in the calendar year 1957.

Fish distribution, calendar year 1957

| Species | Eggs | | Fry | | Fingerlings | | Fish 6 inches or larger | | Total | |
|-----------------|------------|------------------|------------|------------------|-------------|------------------|-------------------------|------------------|-------------|------------------|
| | Number | Weight Pounds | Number | Weight Pounds | Number | Weight Pounds | Number | Weight Pounds | Number | Weight Pounds |
| Largemouth bass | | | 329,900 | 44.6 | 15,128,194 | 28,616.7 | 6,166 | 2,078.6 | 15,464,260 | 30,739.9 |
| Smallmouth bass | | | 179,000 | 5.6 | 109,335 | 201.0 | | | 288,335 | 206.6 |
| White bass | | | | | | | 200 | 400.0 | 200 | 400.0 |
| Warmouth | | | | | | | 51 | 3.5 | 51 | 3.5 |
| Bluegill | | | | | 51,807,878 | 70,347.7 | 7,297 | 1,403.0 | 51,815,175 | 71,750.7 |
| Redear sunfish | | | | | 4,825,384 | 8,383.9 | 50 | 4.0 | 4,825,434 | 8,387.9 |
| Black crappie | | | | | 50,838 | 237.0 | 5 | 1.5 | 50,843 | 238.5 |
| Channel catfish | | | | | 857,859 | 8,965.8 | 128,624 | 14,834.3 | 986,483 | 23,800.1 |
| Bullhead | | | | | 25,172 | 325.3 | 4,043 | 790.3 | 29,215 | 1,115.6 |
| Walleye | | | 7,284,000 | 124.1 | 292,080 | 296.6 | | | 7,546,080 | 420.7 |
| Northern pike | | | 17,170,000 | 441.9 | 1,630,450 | 1,534.1 | 781 | 59.9 | 18,801,231 | 2,035.9 |
| Subtotal | | | 24,962,900 | 616.2 | 74,697,190 | 118,908.1 | 147,217 | 19,575.1 | 99,807,307 | 139,099.4 |
| Cutthroat trout | 258,444 | 53.0 | | | 542,080 | 2,004.9 | | | 904,809 | 13,341.9 |
| Rainbow trout | 1,189,156 | 226.4 | 52,000 | 20.0 | 8,299,631 | 136,075.3 | 52,285 | 11,264.0 | 13,157,674 | 1,041,123.9 |
| Kamloops trout | | | | | 341,345 | 1,224.0 | 3,668,887 | 904,822.2 | 541,345 | 1,224.0 |
| Steelhead trout | | | | | 149,136 | 4,780.0 | | | 276,035 | 19,137.0 |
| Lake trout | 34,960 | 8.1 | | | 7,134 | 174.0 | 126,899 | 14,357.0 | 244,936 | 17,289.1 |
| Brook trout | 3,302,982 | 499.4 | 350,000 | 70.0 | 1,242,661 | 15,640.7 | 202,842 | 17,107.0 | 5,731,985 | 206,879.0 |
| Brown trout | 200,000 | 50.0 | | | 445,438 | 8,656.3 | 836,342 | 190,668.9 | 1,003,107 | 108,505.6 |
| Grayling | | | | | 18,027 | 830.0 | 357,669 | 99,799.3 | 31,117 | 1,433.0 |
| Subtotal | 4,985,542 | 836.9 | 402,000 | 90.0 | 11,245,452 | 169,385.2 | 13,090 | 603.0 | 21,891,008 | 1,408,933.5 |
| Chum salmon | | | | | | | | | 2,555,210 | 4,176.0 |
| Coho salmon | | | 2,155,330 | 1,748.0 | 399,880 | 2,428.0 | | | 1,844,454 | 27,247.0 |
| Sockeye salmon | 600,000 | 166.0 | | | 1,843,133 | 26,878.0 | 1,321 | 369.0 | 5,220,737 | 58,080.0 |
| Kokanee | | | | | 4,347,908 | 46,548.0 | 272,829 | 11,306.0 | 3,407,700 | 1,383.0 |
| Chinook salmon | 6,145,000 | 4,209.0 | 7,177,336 | 6,505.0 | 3,467,760 | 1,383.0 | | | 58,922,672 | 338,117.5 |
| Atlantic salmon | | | | | 45,598,468 | 337,358.5 | 1,868 | 45.0 | 294,280 | 4,746.1 |
| Subtotal | 6,745,000 | 4,375.0 | 9,332,666 | 8,253.0 | 294,280 | 4,746.1 | 276,018 | 11,780.0 | 72,305,113 | 433,749.6 |
| Grand total | 11,730,542 | 5,211.9 | 34,697,566 | 8,959.2 | 141,894,071 | 697,634.9 | 5,681,249 | 1,269,976.5 | 194,003,428 | 1,981,782.5 |

Land acquired or in process of acquisition for fish-cultural stations, fiscal year 1958

[Acres]

| State and fish-cultural station | Acquired in fiscal year 1958 | | | Pending title conveyance |
|---------------------------------|------------------------------|-------------|-------|--------------------------|
| | By other than purchase | By purchase | Total | |
| Arkansas: Norfolk..... | 5 | | 5 | |
| North Carolina: Edenton..... | | | | |
| Vermont: Pittsford..... | | 2 | 2 | |
| Virginia: Paint Bank..... | | 498 | 498 | |
| Washington: | | | | |
| Abernathy..... | | 98 | 98 | |
| Quilcene..... | 5 | | 5 | |
| West Virginia: Bowden..... | | 43 | 43 | |
| Total..... | 10 | 641 | 651 | |

FISHERY RESEARCH

During the past year, application of research results to situations where they are needed most has been expedited. Three in-service training courses for fish culturists covering all fields of fish husbandry, but with particular emphasis on nutrition and disease recognition and control, were operated during the year. From experience, it has been learned that this training brings about greater economy and efficiency in fish-cultural operations.

Sport-fishery research is concerned now with two major fields of work: Research to improve fish cultural practices, and research to improve fishery-management techniques.

In the field of hatchery fish disease research, there has been some good progress for trout and salmon, but no work has been possible for the warm-water species widely used for stocking the thousands of farm ponds in the United States. During the year, three research contracts were in force, with the Oregon Fish Commission, the Washington State Department of Fisheries, and the University of Washington, for research on bacterial and other diseases and parasitic infections of Pacific salmon. Viruses and rickettsias, not known to fish a few years ago, are suspected now of playing an important role in limiting production in some hatcheries. Although there is no satisfactory treatment for these diseases yet, preventive measures have been developed to reduce their incidence. For instance, some foodstuffs must be specially treated before use because they may be carriers of disease. For infections of bacterial origin, successful diagnostic and treatment methods have been found and are being applied.

Sulfa compounds and antibiotics are being used with generally good results, although in some cases we have found drug resistance deve-

oping and new drugs have had to be found to combat particular diseases. More than a hundred reference cultures of bacteria isolated from fish with pathological conditions are maintained at one of the fish-disease laboratories. The sensitivity of each of these cultures to many antibiotics and sulfonamides has been determined, and this collection provides a useful tool for rapid typing of bacteria which may cause either low-grade infections in hatchery fish or, less frequently, explosive mortalities which otherwise would remain unexplained. Disease-research findings are being published regularly in nontechnical language for fish culturists so that prompt application is possible in practical situations.

Some strains of trout from different parts of the eastern United States seem to be resistant to some diseases. These strains have been tested, and there is a possibility of using the most resistant fish for hatchery brood stock and of selectively breeding them for production of disease-resistant offspring.

Fish-hatchery feeding has been changing as nutrition research has progressed. At one of the two fish-nutrition laboratories a pelleted diet has been developed which has maintained trout with good growth and efficiency and low mortality for 18 months, during which time no meat has been fed. Although the fish have not responded so well to handling as the meat-fed fish, progress so far suggests that a complete pellet, cheaper, easier to store, handle, and feed may soon be available for trout hatcheries.

Use of radioactive tracers in the laboratory has made it possible to demonstrate that trout take up calcium directly from the water, both in the egg stage and as feeding hatchery fish. Similarly, fertilizing water with phosphate benefits trout directly and not solely through the food chain as previously supposed.

A rectangular recirculating rearing pond for salmon hatcheries has been developed and tested and has proved somewhat superior, in carrying capacity and in disease-inhibition, food-distribution, and self-cleaning properties, to any of the several types of ponds now in use. Using this type of pond in new hatchery construction or in expansion of old hatcheries should make for cheaper, more efficient operation.

Cleaning of hatchery ponds and raceways to control algal growth has been a time-consuming job and is expensive in terms of labor. Tests of algicides for use at hatcheries are continuing, although a reasonably satisfactory one has been found—this has proved effective when used in very low concentration.

Research to improve fishery management is becoming more important as fishing pressure increases. Fishing possibilities have improved steadily over the past 2 years in waters of Shenandoah and Great Smoky Mountains National Parks as the result of management

studies and application of research findings to different streams in these two parks, which the Bureau has been using as field laboratories. In another such laboratory, several years of careful work on the waters of Yellowstone Lake in Yellowstone National Park have demonstrated that natural spawning can sustain trout production and good trout fishing without supplementary artificial propagation; as a result, eggs are no longer being taken from Yellowstone Lake trout for hatching and stocking.

Over a considerable period of research culminating in findings during the past year, it has been found that hatchery fish produced under good conditions of nutrition and disease control, properly handled and planted, are at least the equal of wild fish in quality and ability to survive. This result points up the possibilities for continued improvements in all aspects of fish husbandry for greater economy and efficiency and better returns to the fishermen.

In March 1958, the President signed an act (Public Law 85-34) authorizing establishment of an experiment station in a suitable rice-growing area for determination of species best suited for cultivation in rotation with rice and other crops, development of methods of production of fishes for stocking and of effective methods for rearing fish to useful size, control of parasites and diseases, of effects on fish and crops of fish and crop rotation, and development of harvesting and merchandising methods. Following passage of the authorization bill, the Congress made available for the fiscal year 1959 a small appropriation for land acquisition, engineering, and planning. The new act provides a challenging opportunity for warm-water fish cultural research for which there is a great and growing need. The construction and program schedule provides for a 3-year development of the experiment station with full-scale program work beginning in the fiscal year 1961.

FISHERY MANAGEMENT SERVICES

Notable in the reorganization of the Fish and Wildlife Service was the establishment of the Branch of Fishery Management Services. Nucleus of the new branch was the program and staff of the Section of Fisheries Management in the former Branch of Game, Fish and Hatcheries.

The program has emphasized work on Federal areas, where assistance was given in planning and carrying out pond and lake surveys, habitat improvement, fish stocking, and other management recommendations. Special effort was given to work on Air Force Bases, in keeping with the cooperative agreement entered into by the Fish and Wildlife Service and the Air Force, December 17, 1956.

The Bureau is not yet able to meet all requests for technical assistance received from administrators of Federal areas, but accomplishments during the past year have been substantial.

Frequent contacts are made with State biologists to promote pooling of resources on large public-fishing projects and to avoid overlapping of activities. Many of these projects are interstate. Management Services is concerned with the best use of fish produced at Federal hatcheries, and toward this end, it assists the Branch Hatcheries in review of applications for fish, helps prepare detailed fish-stocking programs, and carries on a follow-up program to determine survival of hatchery trout, in terms both of success of restoration programs and of returns to the angler.

Extension activities are an important management function in sport fisheries but can be pursued only to a limited degree with the small staff now available. Demonstrations in farm-pond management were held in four States in 1957. Special projects currently active include the fisheries survey of the Upper Mississippi River Conservation Committee; the studies of the Steering Committee for Kanoke River Studies, in which the striped-bass fishery is an important consideration; and the study of the effects of strip mining on streams in Cumberland National Forest in Kentucky.

Fishery management services in sport-fishery programs, for calendar year 1957

| Federal agency | Installations contacted | Reports submitted |
|--|-------------------------|-------------------|
| Force..... | 40 | 44 |
| Survey..... | 33 | 36 |
| Army and Marine Corps..... | 20 | 26 |
| Coast and Geographical Names Administration..... | 8 | 10 |
| National Forests..... | 7 | 14 |
| National Parks..... | 4 | 8 |
| Indian Reservations..... | 13 | 21 |
| Wildlife Refuges..... | 12 | 13 |
| Total..... | 137 | 172 |

RIVER BASIN STUDIES

The Fish and Wildlife Service issued 366 reports this year on river-development projects planned by Federal agencies or by other interests under Federal permits. Of these, 113 were on Corps of Engineers projects, 45 on Bureau of Reclamation, 104 on Department of Agriculture, 47 on projects requiring license from the Federal River Commission, and 57 on special and miscellaneous subjects.

At the request of the International Association of Game, Fish, and Conservation Commissioners, the Department drafted proposed legislation to amend and strengthen the Fish and Wildlife Coordination

Act of 1946. The proposed legislation will provide for more effective integration of fish and wildlife conservation in Federal water resource development and for better conservation of commercial fishery resources, as well as sport fisheries and wildlife. This legislation was subsequently passed and signed into law by the President.

Under provisions of the Coordination Act of 1946, plans were completed for use of seven water-use projects for wildlife management. These include areas in the Riverton irrigation project, Wyoming, and at several reservoirs: Clark Hill in Georgia, Demopolis in Alabama, Green Mountain in Colorado, Lewis and Clark (Gavins Point) in Nebraska, Lewis and Clark in South Dakota, and Orwell in Minnesota.

Channelization of the Colorado River in the Mohave Valley between Davis Dam and Topock has resulted in the stagnation of water and a reduction in the fish and wildlife resources of the upper portion of the Havasu Lake National Wildlife Refuge in Arizona and California. The Bureau developed a plan for circulation of water through the Topock marsh portion of the refuge to eliminate the stagnant-water condition and assist in reestablishment of a suitable environment for fish and wildlife. The Secretary has instructed that an inlet from the river channel be constructed to permit about two second-feet of water to enter and freshen the marsh. This diversion will not increase the present marsh area, and the diverted water will return to the Colorado River at Topock.

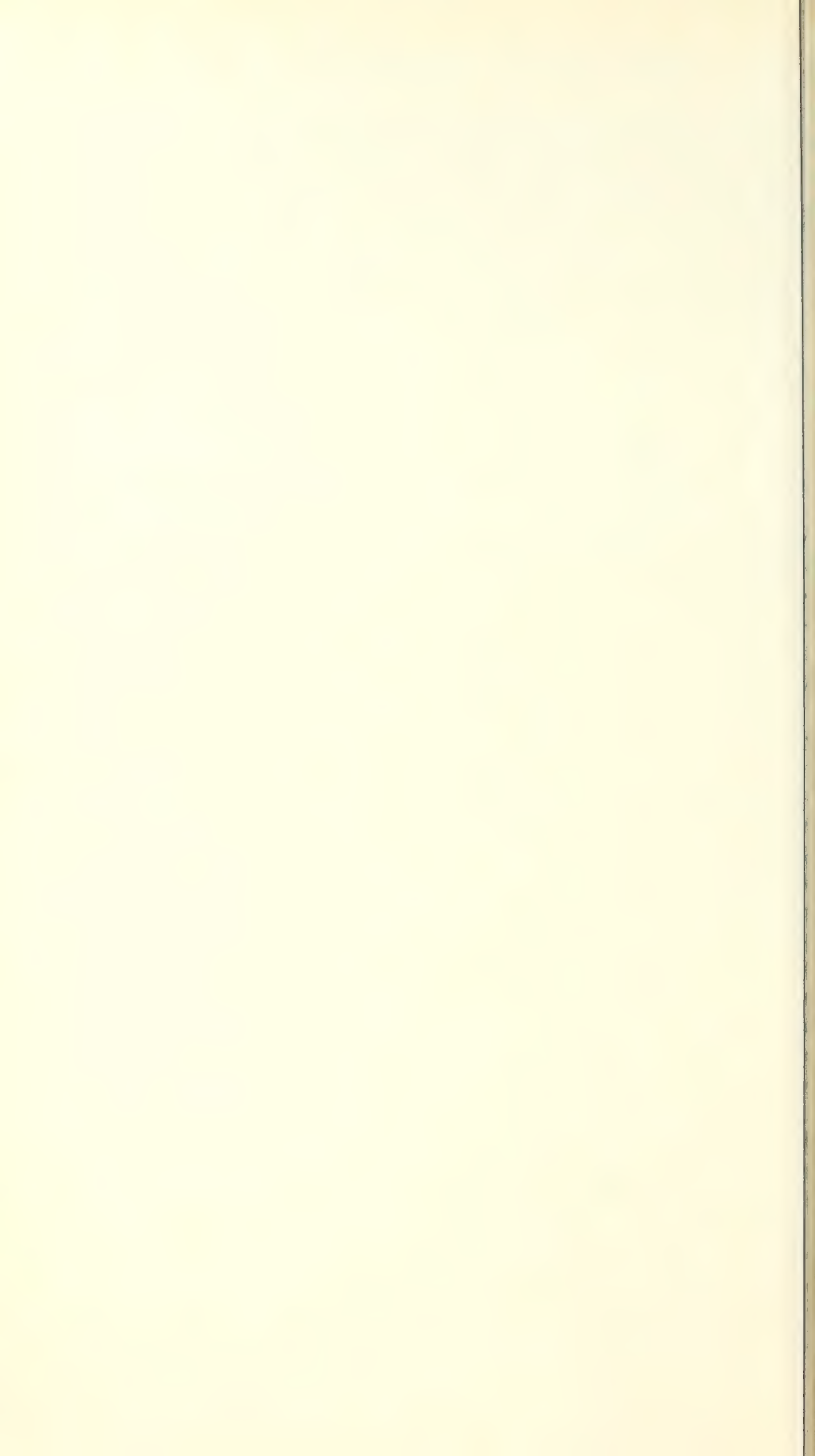
A decision was reached on a long-standing problem of control and use of Federal lands in the Lower Klamath-Tule Lake area of California and Oregon. This is an area important both for agriculture and for wildlife. Based on a study report by his staff, the Secretary decided that it was in the best interest of all to perpetuate the lands needed by 7 million waterfowl of the Pacific flyway with due consideration for agricultural interests. Legislation is presently being drafted to implement this decision.

At Brownlee Dam on the Snake River in Idaho and Oregon, the Idaho Power Co. is constructing a net barrier to prevent young salmon and steelhead trout from being destroyed in the power turbines. These fish will be collected by three "skimmer" devices and carried downstream by tank truck. Fish-protective devices which have been or will be installed by the Idaho Power Co. on the Snake River are in accordance with recommendations of the Department of the Interior and State fishery agencies pursuant to the terms of the license issued by the Federal Power Commission.

At the high Pelton Dam on the Deschutes River in Oregon, another type of "skimmer" device designed to move seaward-migrating young salmonoid fishes safely past this dam has already been completed.

ruled. This device was also recommended by the State and Federal fishery agencies in accordance with provisions of the Federal power Commission license. Since these devices are untried, the Federal and State fishery agencies, in cooperation with the construction agencies, are developing research programs to determine their effectiveness. Service technicians have helped develop plans for these fish-protective devices as well as devices for other Columbia Basin dams under construction, including Priest Rapids Rocky Reach Dams on the Columbia, and Ice Harbor and Brownlee Dams on the Snake River.

Hearings were held last September in connection with the Service's proposed withdrawal of Salmon River public lands in Idaho. The proposal is still under consideration by the Bureau of Land Management. The purpose of the proposed withdrawal is to protect salmon-hawking grounds from all forms of appropriation under the public-land laws, including the general-mining laws but not the mineral-leasing laws.



BUREAU OF COMMERCIAL FISHERIES

Donald L. McKernan, *Director*



INDUSTRIAL RESEARCH AND SERVICES

TO HELP ASSURE sound use of the Nation's fishery resources, the Bureau of Commercial Fisheries continued its activities in exploratory fishing and gear research, technology, economics, market news, statistics, market development, and loans and grants. The Salmonstall-Kennedy Act again provided funds to help the domestic fisheries, with special emphasis on research and marketing.

Commercial concentrations of shrimp were located by the exploratory-fishing vessel *John N. Cobb* off the northern Oregon and Washington coasts in areas not previously exploited by the ever-increasing commercial shrimp fleet. Shrimp resources with a tremendous commercial potential were discovered in the Shumagin Islands area of Alaska by the vessel *Tordenskjold*, under charter to the Service. More precise information on seasonal distribution and availability of herring in North Atlantic offshore waters was gathered by the exploratory vessel *Delaware* during several fishing operations. The simple electrical telemeter has been refined to supply continuous subsurface temperature data as well as to define the depth of the net. Considerable progress has been made by the research vessel *Oregon* in determining the species of fish available from midwater and surface schools in the Gulf of Mexico.

Catches of red snapper by heavy-duty fish trawls in the Gulf of Mexico have exceeded those by conventional handline methods. The most significant advantage in this new method is reduction in manpower.

The marine-products research program has continued along three major lines of effort to solve technological problems in processing and distributing fish and fishery products. Fundamental studies of physiological and chemical properties of fish and shellfish have yielded valuable information on the enzymology of fish flesh, on the structure, stability,

and chemical reactivities of fish body oils, and on the feasibility of radiation-preservation of seafoods.

Applied research has developed data to show the usefulness of fish oils in diets, in leather dressing, in ore flotation, and in other applications; data on the refrigeration of fish; and data necessary for the development of the three voluntary United States standards for fishery products now in effect.

The third line of effort has been to encourage faster application of technological knowledge by means of publications, scheduled plant visits, and demonstrations.

A new technological laboratory is to be constructed at Gloucester, Mass., and a 2-acre site has been donated by the city of Gloucester.

Wise use of fishery products goes hand in hand with wise production policies and conservation of natural resources. To this end, studies were made of the numerous factors of distribution, including transportation costs and services provided by the different carriers, margin or producer-consumer price spread studies, and other studies on the marketing and distribution of fishery products. Economic factors affecting supply were studied, as well as prices of fish and fishery products; the relation of these to prices of other foods and commodities; wages and employment in the fisheries and allied industries; effects of controlled fishing, as in the Pacific Coast commercial halibut fishery; and problems of competition between domestic fishery products and imports.

Results of the general statistical surveys of all sections of the United States to obtain detailed data on employment in the fisheries, volume and value of the catch, and production of manufactured fishery products for calendar year 1956 were compiled and readied for publication. Similar surveys for 1957 are under way.

Monthly bulletins on landings of fish and shellfish in 13 coastal States and Ohio were continued, and publication of a monthly bulletin on landings in Louisiana was undertaken. Monthly summaries of the catch were released, and a detailed review of the fisheries of the United States and Alaska for 1957 was published.

Detailed economic and biological data on landings of fish and shellfish in the North Atlantic and of shrimp in the South Atlantic and Gulf areas were assembled and released. Considerable attention was given to New England groundfish and Pacific tuna, in connection with proposed legislation for assistance for these fisheries. Information on the United States catch off foreign coasts was assembled for the use of United States Delegation to the United Nations Conference on the Law of the Sea, in Geneva, Switzerland.

The Bureau's home economists presented 151 fish-cookery demonstrations, participated in four national conventions, and developed

tested recipes for institutional and homemakers' use, distributing these through booklets, recipe folders, and copy for radio, television, and food editors.

Special market promotions included development and distribution of recorded radio spot announcements dealing with the nutritional value of fishery products. These announcements were sent to some 200 radio stations throughout the country. Consumer education was furthered by distribution of 2 million fish and shellfish recipe folders through retail food outlets.

Activity increased in developing markets for under-utilized fish. As man-made water impoundments increase throughout the country, the supply of varieties of fish not readily accepted by consumers has been increasing. New markets in the animal-food field, successfully developed during the Service's research effort in the Lake Erie area, are being expanded to other areas which are experiencing rough-fish marketing problems.

Thirteen fishery educational films are now in distribution through some 150 cooperating film libraries and Government distribution channels, with an annual viewing audience of about a million persons, exclusive of television.

Specific information which can be used in estimating the current market for fresh, frozen, and canned fishery products is provided by Daily Market News "Fishery Products Reports." These reports encourage the orderly marketing of fishery products and byproducts and help in the sound use of our natural resources.

These reports are issued daily on all aspects of the fishing industry by the use of fishermen, buyers, and distributors. Information on landings, receipts, stocks, market conditions, prices at the dock and wholesale, wholesale prices of frozen and canned fishery products, and market conditions for all types of fishery products, is collected, analyzed, and disseminated from Boston, New York City, Hampton (Virginia), New Orleans, San Pedro (California), Seattle, and Chicago.

The monthly Commercial Fisheries Review continues to feature articles and news of trends and developments in the fishery industries of the United States and foreign countries. During 1958, the periodical published news on developments and findings as a result of research and services financed by Saltonstall-Kennedy funds.

An office was established in November 1957 to conduct studies and prepare working documents, position papers, and reports on foreign and domestic fisheries as required by the Fish and Wildlife Act of 1966; to conduct studies and provide services on foreign trade and tariff problems; and to service the fishery attachés and the foreign fishery reporting program.

Upon request of industry, a report was submitted to the President and the Congress on trends in production, employment, prices, and imports of fresh and frozen yellowfin, skipjack, and bigeye tuna. In conjunction with the State Department Foreign Service program, a fishery-attaché post was established in Mexico City and one in Tokyo to cover developments in these important fishing areas. The reporting requirements for reporting from foreign posts throughout the world were modified to comply with the broader requirements for foreign reporting under the Fish and Wildlife Act of 1956. Data have been collected for a 5-year summary and analysis of the United States foreign trade in fishery products.

The fisheries-loan program authorized by the Fish and Wildlife Act of 1956 was continued during the year. Nearly 200 applications totaling \$6,000,000, were received. During the 20 months that the program has been in operation, 445 applications totaling over \$16,000,000 were filed with the Department. Of these applications, 240 totaling \$6,000,000 have been approved, and 140 totaling \$4,200,000 have been declined or found ineligible.

These loans are made for financing and refinancing operation and maintenance, replacement, repair, and equipment of fishing gear on vessels, and for research into the basic problems of fisheries. Owing to the tight credit situation and depressed conditions in the fishing industry, most fishing-vessel operators have been unable to obtain financing from any other source. It has been estimated that the 1957 catch of the first 163 vessels to receive funds from this program totaled 600,000 pounds.

ALASKA COMMERCIAL FISHERIES

Products of the Alaska fisheries, including fur-seal byproduct, for the calendar year 1957 totaled 200,359,388 pounds with a wholesale value of \$79,472,050, as compared with a total of 229,271,365 pounds valued at \$94,618,421 for 1956. While there were minor declines in the landings of herring and halibut, the principal decline was in salmon production. The decline occurred in all three regions of Alaska, but was particularly prevalent in central Alaska. In the minor species there were sizable increases in the production of sablefish and crabs. Sablefish production increased from 1,941,366 pounds valued at \$311,918 in 1956 to 3,548,187 pounds valued at \$416,347 in 1957. Crabs increased from a total of 2,125,582 pounds valued at \$2,010,775 in 1956 to 3,980,000 pounds valued at \$3,646,383 in 1957. The principal increase in crab production was in central Alaska where 1,406,988 pounds valued at \$1,299,506 were produced in 1956 as compared with 3,740,524 pounds valued at \$3,402,440 in 1957.

There were 23,130 persons engaged in the fisheries of Alaska in 1957, of which 12,203 were fishermen, 1,294 were transporters, and 9,633 were shoresmen, operating out of a total of 170 wholesaling and manufacturing establishments. This compared with a total of 24,549 persons engaged in the fisheries in 1956, of which 13,458 were fishermen, 1,510 were transporters, and 9,581 were shoresmen, operating out of 165 wholesaling and manufacturing establishments. Of the 170 establishments operating in 1957, 91 were engaged in canning fish and shellfish, 65 were engaged in handling fresh and frozen fish and shellfish, 31 were engaged in curing fish, and 8 operated as byproducts plants.

Gear used in the salmon fishery in 1957 included 1,179 purse seines, 8 beach seines, 6,010 gill nets, 5 fish wheels, 31,624 salmon troll hooks, and 215 traps. In comparison, the gear used in the salmon fishery in 1956 consisted of 1,136 purse seines, 256 beach seines, 8,072 gill nets, 22,369 salmon troll hooks, and 247 traps.

In addition to 97 permanent personnel, the Bureau seasonally employs temporary stream guards to supplement enforcement activities, and a total of 282 temporary stream guards were hired in 1957 for that purpose. In conjunction with this program, eight seagoing vessels were used in addition to numerous launches and outboard-motor skiffs. This patrol was supplemented by an aircraft fleet of 5 twin-engine planes in addition to 2 smaller single-engine aircraft.

A 3-acre site was purchased for a new biological laboratory at Unalaska.

COLUMBIA RIVER FISHERIES PROGRAM

In the reorganization of the Fish and Wildlife Service, a Branch of Columbia River Fisheries is being activated in the Bureau of Commercial Fisheries. This Branch is responsible for the Columbia River Fisheries Program throughout the area accessible to anadromous fish. Because of the importance of the fisheries resources of the Columbia River and the rapid development of the river for such purposes as production of electricity, irrigation, and flood control, it is essential that increased attention be devoted to this activity. A variety of programs are coordinated by the Branch, including the multimillion-dollar Columbia River Fishery Development Program, which has as its purpose the full development of the production potential of the river as still available to anadromous fish and the mitigation of fishery losses resulting from construction of dams. Other functions include studies of the effects of proposed water-use developments on the fishery resources and recommendations relating thereto, and design of fish-protective facilities.

Since Congress first appropriated funds in 1949 for the Columbia River Fishery Development Program, 15 fish-cultural stations have been constructed or rebuilt. Log jams and other obstructions in more than 1,000 miles of streams have been removed, and approximately \$2,500,000 spent on fishways and screens. The production of many streams has increased, and new runs of salmon have been started in tributaries where none existed before.

Facilities for capturing downstream-migrating salmon and steelhead in the forebay of a relatively high dam were placed in operation in the spring of 1958 at Pelton Dam on the Deschutes River in Oregon. Here also the longest fish ladder in existence, some 3 miles in length, went into operation. Personnel of the Bureau of Commercial Fisheries assisted in the design of these facilities.

PRIBILOF ISLANDS FUR-SEAL INDUSTRY

In calendar year 1957, the fur-seal herd of the Pribilof Islands, Alaska, under the management of the Department of the Interior, produced 93,618 sealskins as compared with 122,826 skins in 1956. As in the previous year, much of the take in 1957 consisted of excess animals taken to reduce the size of the herd. The take was divided in accordance with the Provisional Fur-Seal Agreement of 1947. 20 percent of the skins were delivered to the Government of Canada. Production on the islands also included 374 tons of fur-seal meal and 53,292 gallons of oil. The meal and oil was sold by competitive bidding for a total of \$56,470.

The following quantities of United States Government-owned fur seal skins were sold at public auction in St. Louis, Mo., during 1957: 27,819 skins on April 12 for \$2,521,710; 28,782 skins on October 1 for \$1,963,376.

BIOLOGICAL RESEARCH

Coastal Fisheries

The objectives of research on commercial shellfish are to obtain knowledge which will make it possible to control predators and diseases, to provide favorable environment, and to improve methods of culture—thereby increasing production.

Small hard-shell clams artificially propagated at the Milford, Connecticut, Laboratory were used in field experiments in Rhode Island and Virginia, showing that survival was poor unless predatory crabs and oyster drills were excluded by screens or fences. By the time clams reached a length of about 1 inch they were buried deeply enough

the drills and had thick shells which crabs could not break. Commercial clam farmers in these areas must therefore provide protection for the seed for the first year.

The oyster industry of Long Island Sound, which was already in serious condition because of hurricanes and lack of seed oysters, had another crisis when the predatory starfish population increased tenfold. The industry applied control methods developed and recommended by the Milford Laboratory, but losses of oysters will be great. Research to develop better methods of predator control and increases of seed oysters will be increased to assist this industry.

Laboratory and field experiments to find new methods for controlling various predators of shellfish continued with some success. The testing of chemicals, in search of specific poisons, several compounds were discovered which can be used to control undesirable gastropods in cultures of phytoplankton used for food in the artificial propagation of shellfish. It was also discovered that enemies and competitors of oysters such as the boring sponges, tunicates, and starfish can be destroyed by immersing them briefly in a saturated solution of table salt.

Successful field trials of barriers designed to exclude oyster drills from oyster beds were continued at Chincoteague Bay in Virginia. These barriers are based on recent Bureau research which showed that certain species of drills are repelled by copper ions.

The Fish and Wildlife Service, as research agency of the Atlantic States Marine Fisheries Commission, continued its investigations of Atlantic-coast shad fisheries. Creel censuses were conducted in 1957 on the Connecticut River in Connecticut and Massachusetts and in 1958 on the St. Johns River in Florida, to determine the size of the shad sport fisheries. The Connecticut River sport catch was 10 percent of the commercial fishery, and the St. Johns was 29 percent. To determine the effect of dam construction on the Atlantic-coast anadromous fish populations, the Beaufort, N. C., Laboratory is cooperating with other agencies in designing fish-passing facilities on the Connecticut River and for Little Falls on the Potomac River.

Approximately 2,000 striped bass in Albemarle Sound, N. C., were tagged from November 1957 through March 1958, to estimate the population and the fishing rate in the commercial fishery. Population estimates varied little between the 1956-57 and the 1957-58 commercial fishing seasons. During November and December 1956 (these months represent the period of stabilized effort) the fishing rate was approximately twice as intense as in the same period of 1957. Fishing effort totaled 9,000 standard fishing-unit days for this period in 1957.

Readings of scale samples showed that the commercial catch of tagged bass in Albemarle Sound in 1957-58 had a greater per-

centage of 11½-year-old fish and a smaller percentage of 21½-year-old fish than in 1956-57. The increase in 11½-year-old fish resulted from the relatively large production of young in the Roanoke River in 1956. The Roanoke River spawning run in 1958 appeared equal or larger than the 1956 and 1957 runs, each of which consisted of about 170,000 fish.

Studies on the blue crabs of the Neuse River in North Carolina to determine the causes of fluctuations in abundance, found the catch in 1957 was 1,290,000 pounds, the fishing rate 25 percent, and the population size approximately 5 million pounds.

The continental origin of stocks of Pacific salmon taken on the North Pacific Ocean is becoming apparent through research at Seattle, Wash., in meristics, serology, parasitology, and scale analysis. Research on the high seas has revealed the general ocean distribution of salmon and the oceanographic features of the area inhabited by salmon.

Continuing experiments in electrical guiding of downstream migrant salmon fingerlings at Lake Tapps, near Auburn, Wash., indicate the possibility of developing electrical barriers for fish protection and passage over hydroelectric projects. The installation consists of 5 rows of electrodes, creating 4 electrical fields with intensities increasing downstream. In traps that caught the guided salmon and the unguided salmon, some 3,000 fish were taken in the first 6 weeks.

Electrical barrier to guide salmon at Lake Tapps, Auburn, Wash.



the experiments; from 75 to 97 percent were caught in the guided ups, with the average between 85 and 90 percent. Higher percentages are expected, as improvements are made.

Research was conducted at the fishways at the Bonneville Fisheries-Engineering Research Facility at Bonneville Dam, on upstream-migrant adult salmon to find more economical methods of providing the passage for them. Experiments to measure the capacity of pool-type fishways gave a figure of 3,000 fish an hour in a 4-foot-wide fishway. Tests comparing the swimming abilities of chinook salmon and steelhead showed the steelhead to be greatly superior. At a water velocity of 8 feet a second 100 percent of both species passed through the 80-foot channel. At a velocity of 13 feet a second, approximately 100 percent of the steelhead passed through, while only 50 percent of the chinooks could pass. At a velocity of 16 feet a second, about 50 percent of the steelheads passed through, but fewer than 5 percent of the chinooks. Both chinooks and steelheads selected the higher of the two water velocities when presented a choice. Faced with a choice between a lighted channel and a darkened one, steelheads chose the lighted channel while chinooks appeared indifferent to the difference in light.

Investigation of the effect of fishway slope began with a comparison of fish passage through two short fishways with slopes of 1 to 16 and 1 to 8. Ascent was faster in the 1-to-8 fishway. To relate the information to longer fishways, comparisons are being made in two "endless" fishways in which fish can ascend indefinitely. These tests will show the effect of fishway slope on the rate of passage, its relation to fish fatigue, and the maximum height that fish will ascend in pool-type fishways. This information will be of value in the design of fishways for high dams.

and Fisheries

Four field tests of selective toxicants developed at the Hammond Laboratory, Mich., have brought chemical control of the sea lamprey near the point of large-scale application. The tests proved that larval lampreys can be killed in tributary streams without significant damage to native fish.

Electrical-barrier systems that prevent adult lampreys from spawning in tributary streams of Lake Superior and Lake Michigan have been improved and expanded. The most effective control of lampreys will require the use both of electricity and of chemicals.

The Bureau of Commercial Fisheries, the Great Lakes Fishery Commission, the Lake States, and Ontario are cooperatively developing plans for restoring lake trout and other lamprey-depleted species as the depredations of the lamprey are reduced.



"Endless" fishway under construction at Bonneville to test ability of fish to pass high dams.

The State of Michigan, acting on Bureau findings, changed its regulations so as to improve the economic status of the commercial fishermen of Saginaw Bay in Lake Huron.

Marine Fisheries

Marine-fishery research in fiscal 1958 brought intensive effort to identify populations—the separate units of American fisheries which must be studied to explain abundance variations, to forecast fishing success, and to develop new ways of managing to obtain the highest sustained production. The movements of fish, shrimp, and sea scallops were studied through tagging. Research using natural tags such as parasite infections, blood types, and fish body characteristics have contributed much new knowledge. Studies of the ocean environment and its effect on fishery populations were continued, and changes, especially in the Pacific, were noted.

Investigations of various ground fishes were continued on New England fishing banks and in the Gulf of Maine. Recoveries of tagged yellowtail flounders indicate that fish from southern New England grounds and the southeast part of Georges Bank are of homogeneous stock or of two intermingling stocks. Studies of inshore population of redfish at Eastport, Maine, revealed that the group does not migrate. Tagged fish which were recaptured, all were from within half a mile of the tagging site during a 20-month period. Previous estimates of very slow redfish growth were confirmed.

Investigation of the Georges Bank sea scallop has progressed so that increases in production are deemed possible by increasing the sizes in dredges, thus allowing the smaller scallops to remain in the ocean during their period of most rapid growth. Sea-scallop conservation is now under consideration by the International Commission for the Northwest Atlantic Fisheries.

Further work with an underwater television camera showed the behavior of cod, haddock, whittings, and flounders captured in trawl and demonstrated that netting placed on the outside of the nets prevented chafing did not stop the small sizes of these species from slipping through the meshes.

Research on the Atlantic herring shows there is little intermingling of adult sizes between Gulf of Maine and Gulf of St. Lawrence populations. Surveys on Georges Bank revealed that this is an important spawning area and that herring spawning there have different parasites and blood characteristics from those which spawn in the Scotian waters, thus indicating separate stocks.

Studies of the Atlantic menhaden resource show that fluctuations in the total Atlantic-coast catch have resulted from variations in

abundance of fish rather than from their movements or behavior. A very large year-brood was produced in 1951, but lower abundance of recent year-broods caused a reduction in the 1957 catch.

A new method of marking shrimp by colored stains was given field trials at the close of the year. The mark on the shrimp that remains after shedding furnishes reliable material for estimating growth and mortality.

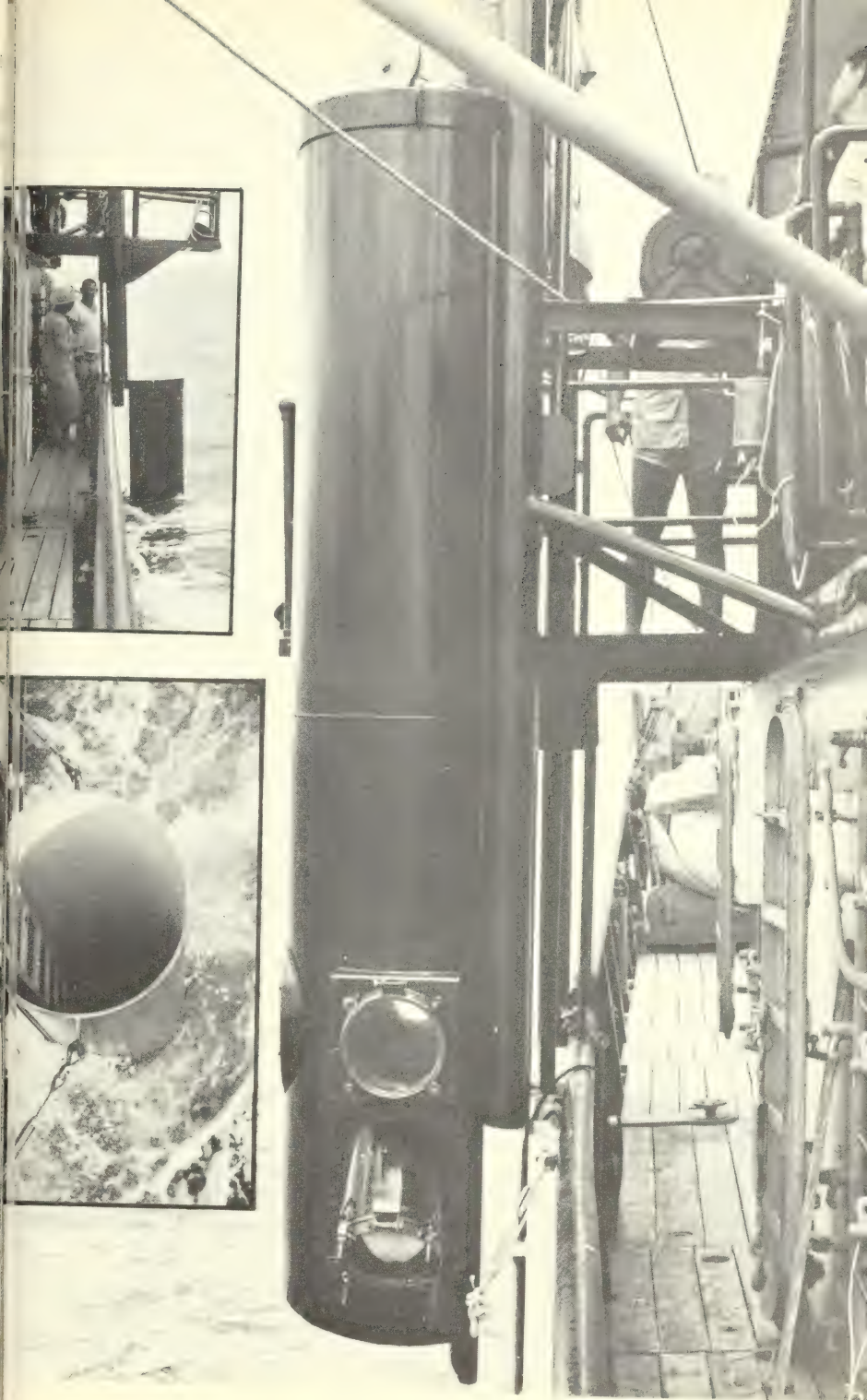
During an outbreak of the fish-killing "red tide" on the Florida west coast in the fall of 1957 the first extensive attempt at control was made by spreading 105 tons of copper sulfate with crop-dusting airplanes. Although moderately successful, the method proved to be expensive for controlling large outbreaks.

Studies of the life history of white and brown shrimp in the inland Gulf of Mexico waters show that each species reaches a peak of abundance at a different season, the brown shrimp in May and the white shrimp later in the year. This sharply reduces the interspecific competition on the nursery grounds.

Surface temperatures off California and Baja California were 1 to 3° C. above those of recent years and resemble those of the period before a sharp decline of the sardine fishery occurred in 1946 and 1947. This was part of a North-Pacific-wide (and perhaps Pacific-wide or worldwide) change. In the California region, higher surface temperatures were associated with below-average northerly wind, reduced flow of the California current, and perhaps increased flow of the inshore countercurrent. Sardine spawning shifted northward and was concentrated off southern California. Some spawning occurred as far north as off Monterey for the first time since 1950. Live-bait catches suggest that the 1957 class of sardines may be an outstanding year-class.

Studies at Stanford, Calif., which have indexed the wind system over the North Pacific Ocean for the last 30 years, show that abnormally strong northwesterly winds have passed through an 8-year period along our west coast. In 1957 there was reversion to the pre-1947 conditions of generally weaker northwesterlies. Since the period of high winds, cold water, and southerly spawning coincide roughly with each other and with the scarcity of California sardines, we can hope that the shift in climatic and oceanic conditions may start restoration of the sardine fishery upward from the low levels of the last decade.

Biological and exploratory research on central Pacific tuna resources involved variations in distribution and abundance, the biology and the ecology of surface tuna in northeastern French Oceania (Marquesas Islands), skipjack tuna in Hawaiian waters, and albacore of the northeastern Pacific. Surface tuna are considerably more available during the Marquesan summer than during the winter.



"Submarine bucket" for observation of skipjack

To study their movements, 5,515 skipjack tuna were tagged in Hawaiian waters during the summer of 1957. The recoveries gave a pattern of migration consistent with the hypothesis that skipjack enter the Hawaiian area generally from the south or southeast and depart from the northwest.

In the summer of 1957 the Service participated with California, Oregon, and Washington in a northeastern Pacific albacore survey to define the distribution of albacore off the west coast of the United States. The results of the survey disclosed that albacore were widely distributed in commercial or near-commercial quantities.

New advances were made in the study of tuna behavior and the reaction to species used for bait. Direct underwater observation of feeding tuna schools was made possible by the development of a "submarine bucket."

Studies of tuna distribution in relation to environment and of the behavior are directed toward producing information which will enable fishermen to be more efficient in harvesting this important oceanic resource.

Office of the Administrative Assistant Secretary

D. Otis Beasley, *Administrative Assistant Secretary*



RESPONSIBILITIES for departmental administrative management activities of the Secretary are executed by the Administrative Assistant Secretary. In performing these functions, the Administrative Assistant Secretary directs and supervises seven Secretarial divisions.

Under the auspices of the Administrative Assistant Secretary and staff divisions, two Departmentwide Management Conferences for executives were held during the past year. Over 250 area and regional directors and their top assistants joined in the program, designed to broaden their understanding of policymaking and administration. The conferences promoted a cooperative approach to matters of common interest and concern through sharing management ideas and experiences. The conferences were unique in that they were departmental in scope and emphasized problems of general management rather than specific program problems. A summary of the conferences is being printed under the title "Strengthening Management of the Interior."

A short report for each of the Secretarial divisions—Administrative Services, Budget and Finance, Inspection, Management Research, Personnel Management, Property Management, and Security—follows, summarizing activities during the past year.

Division of Administrative Services

Floyd E. Dotson, *Director*

The Division provides complete housekeeping and operating services to the Office of the Secretary and other departmental offices, and furnishes centralized supply, communication, and reproduction facilities for the benefit of other departmental installations and offices in the Washington metropolitan area. In 1958, the workload increased approximately 2 percent over 1957, but the additional work was handled without expansion of staff or facilities.

Particular highlights of the year were: (1) Personnel reporting requirements were consolidated and job classification processes were simplified; (2) The Division furnished staff instructors and other services to the Divisions of Personnel and Property Management in connection with an expanded employee training program; (3) The Library established a central depository for all translations prepared or purchased by the Department; (4) The Office of Geography was moved to quarters outside the Interior Building; and (5) A continuing campaign to reduce volume of record holdings led to the destruction or transfer of more than 2,000 cubic feet of inactive and obsolete material. This reduction released 78 file cases and 700 linear feet of shelf space for other uses. Reapportionment of the space utilized by the Office of Geography enabled the acquiring bureaus and offices to realign their units for greater operating efficiency and convenience.

Division of Budget and Finance

Sidney D. Larson, *Director*

The Division of Budget and Finance is responsible for staff supervision of the financial management program of the Department of the Interior. This includes budgeting, accounting, auditing, financial reporting, fiscal policies and procedures, and the application of data processing to financial activities. The Division represents the Department in the field of financial management in liaison with

General Accounting Office, Bureau of the Budget, Treasury Department, other Federal agencies, and appropriation committees of Congress.

The budget activities for the year included the processing of two regular budgets—one for the Bureau of Reclamation and the Power Marketing Agencies and one for the other bureaus, and two supplemental budgets. Work continued on improving justifications and in coordinating the bureaus' budget patterns with their organization patterns.

Controls were maintained over expenditures for the year, with expenditures totaling \$666 million compared to an estimate of \$683 million.

Efforts were continued to improve the accounting and financial management systems. Progress has been made on a new system for the United States Fish and Wildlife Service. Most of the bureaus have modern systems which have been approved by the Comptroller General. For these bureaus, the year's program involved mainly a review of their effectiveness. For this purpose, a joint review by representatives of the Division, Bureau of the Budget, and the GAO was conducted with heads of bureaus.

The Division continued to cooperate with the GAO and with the bureaus of the Department in a comprehensive audit program. In fiscal year 1958, the Division reviewed a total of 28 audit reports issued by the GAO and 178 internal audit reports rendered by Department of the Interior bureaus and took appropriate action where necessary.

Division of Inspection

W. Darlington Denit, *Director*

The Division of Inspection is responsible for the inspection and investigative activities of the Department. The primary purpose of the Department's Inspection Program is to insure high ethical standards in the management of the Department's affairs. Major responsibility for actual inspection performance is placed in the bureaus of the Department. The Division of Inspection provides policy guidance and coordination for the bureau efforts.

In the past fiscal year, the development of systematic inspection procedures through the widespread field organization of the Department continued. By appropriate reporting requirements, the inspections have supplied valuable management knowledge and constitute the basis for important preventive measures. By increasing participation of the Division of Inspection in Department and bureau management conferences, it has been possible to impart program information and policy interpretations on a direct basis.

The investigative program embodies special investigations of alleged administrative irregularities in the discharge of official duties. Special agents attached to the Division of Inspection are also used for such other investigative assignments as may be within the responsibility of the Department and authorized by the Administrative Assistant Secretary. During the past fiscal year, investigative work was maintained on a current basis.

The Division of Inspection also has responsibilities in the handling of matters under the Government Employment Policy on Nondiscrimination provided in Executive Order 10590 and related Department regulations. Application of the policy objectives and the special regulations continued on a very satisfactory plane. Specific complaints of discrimination remain at a minimum.

Division of Management Research

Arthur B. Jebens, *Director*

The Division of Management Research contributes active assistance and leadership in the development of policies and programs relating to the organization and general management of the Department. This includes surveys and studies of Departmental operations to insure the most efficient and effective implementation of management techniques.

The Division is responsible for overall development and staff supervision of the Department's management improvement program, the directive system, committee management, and incentive awards.

During the past year the Division assisted in conducting a survey of the administrative functions of the Fish and Wildlife Service. The survey encompassed a study of all administrative-type work performed by administrative and program personnel of both the Bureau of Sport Fisheries and Wildlife and of Commercial Fisheries.

The Management Improvement Program was given added emphasis during the past year. This program provides the Department with a formal and organized means of identifying and taking action on specific problems or areas where improvement seems possible and of testing new ideas and exploring alternative solutions to management problems.

The following reflects a cross-section of projects and highlights the diversified nature of management assistance provided by this Division: (1) Assisted in the transfer of Connally Act functions from the Office of Oil and Gas to the Geological Survey; (2) Developed a program to ensure that proposed public regulations were issued as proposed rule making in advance of their official promulgation and to make such regulations more informative to the public; (3) Prepared a policy statement for inclusion in the Departmental Manual relating to the Department's legislative activities; (4) Established tailored procedures for the Departmental Correspondence Control system; (5) Surveyed the basic management practices with respect to the Department's research and development activities; (6) Coordinated the preparation of materials for an orientation program for newly appointed, top-level noncareer officials of the Department; (7) Conducted a survey of the grant-in-aid programs of the Fish and Wildlife Service; (8) Participated in a management review of the Bureau of Indian Affairs tax practices with regard to grazing cases on the Pine Ridge Reservation; (9) Resolved procedural problems in creating and documenting advisory and interagency committees. The Division's Branch of Directives Management administered a system for the preparation, review, and issuance of Secretarial directives to the bureaus and offices and for other documents requiring publication under Secretarial authority. Of the more than 250 documents on which Secretarial action was taken during the past year, 6 were Federal Register documents—regulations, notices of proposed rule making, delegations of authority, and general notices—16 were Departmental Manual releases; and 19 were proposed Presidential documents originated by the Department or referred to it by other agencies. The Branch also provided staff assistance to the bureaus and offices in the management of their internal directives systems.

During the past year, significant changes were made in the operating procedures and practices of the Division's Branch of Incentive Awards as a result of a review of its internal operations. The Branch revised and reissued the incentive awards handbook as part of the Departmental Manual. Also during the year an analysis of the Superior Performance Award program was completed. Department-



Under Secretary Chilson congratulating the recipients of the Department's Valor Award given at the Nineteenth Honor Awards Convocation, February 5, 1958.

wide participation in the Incentive Awards again showed an upswing as indicated in the following statistics:

Type:

| | Number |
|-----------------------------------|--------|
| Suggestions | 4, 588 |
| Superior Performance Awards..... | 1, 190 |
| Special Act Awards..... | 63 |
| Distinguished Service Awards..... | 20 |
| Meritorious Service Awards..... | 133 |
| Commendable Service Awards..... | 37 |
| Valor Awards..... | |

Division of Personnel Management

Newell B. Terry, *Director*

Major emphasis during the year was placed on overall career planning. A simple graphic presentation was developed as a means of encouraging bureaus to develop and improve careers within their

jurisdictions. A further step was the starting of career planning across bureau lines. Studies of this kind have included geologists, personnel officers, and teachers. Another aid in this program was the establishment of an interbureau vacancy announcement system.

In the career-development field, special attention was given to the Department's promotion policy. A new policy was issued early in the fiscal year, and as a result of the Civil Service Commission's new promotion program, this policy was later strengthened and reissued.

The major personnel utilization program stressed was developing technician positions as a means of relieving the shortage of scientists and engineers.

Early in fiscal year 1958 the Department of the Interior placed a personnel ceiling program in effect. Each bureau was assigned employment ceilings for each quarter of the fiscal year. Administration of the personnel ceiling program has stabilized employment and encouraged increased attention to the maximum utilization of primary and secondary skills of employees.

The safety function is currently expanding and finding wide areas in field operations where management can lower manpower and property losses from accidents. Communications regarding unsafe actions and conditions have materially improved through the cooperation of bureau offices and over 450 active field safety committees. The 1957 work-injury rate is the lowest on record in the past 10 years.

As an aid to the bureaus in conducting their personnel programs, a Guide on Employee Hearings Procedures and a Guide on Orientation and Placement Follow-Up were issued.

A major undertaking was a comprehensive review of the Department's labor relations policies affecting all employees, and the formulation of detailed procedures governing formal labor-management negotiations for industrial type employees. The combined assistance and advice of representatives of labor organizations, the Civil Service Commission, and bureau administrative officials contributed to the successful completion of this study.

Division of Property Management

N. O. Wood, Jr., *Director*

Continued progress was registered in the departmental program upgrading and improving the quality of automotive vehicles, construction, and work equipment. Under this program, equipment of

all types is periodically screened for replacement or disposal. Obsolete or uneconomical equipment is replaced by transfers from other agencies or by purchase of new items, and equipment no longer required by current programs is disposed of under applicable regulations. During fiscal year 1958, replacement equipment with original cost exceeding \$10 million was obtained without cost through the upgrading procedure.

The Department placed greater emphasis on the prompt identification and disposal of unneeded administrative real property, through a systematic and periodic review.

In its correspondence and paperwork improvement areas, letter-writing courses were given to more than 1,200 officials. Record disposal activities resulted in freeing over 44,000 cubic feet of filing space and obviated purchases of new filing equipment.

Policy and procedural guides were published in the Departmental Manual to cover a number of improved practices in the purchasing and contracting fields, and continued support was given to the President's Task Force for Improvement of Federal Government Procurement.

Plans were initiated for a series of week-long field conferences at selected locations to train employees engaged in property and record management functions.

Radio-frequency assignments made to the bureaus and offices totaled 282 for the year, and 120 individual station assignments were registered with the International Telecommunication Union. Assistance was rendered the Office of Defense Mobilization in frequency allocation planning and in preparatory work for the 1959 international administrative radio conference. Communication tests were conducted bimonthly at the departmental relocation site and the communications center was activated 2 weeks in July for Operation Alert 1958.

Division of Security

J. Cordell Moore, *Director*

The physical security phase of the Division of Security's responsibility was emphasized during the fiscal year. New regulations have been issued and a training course for employees handling classified documents was instituted.

A disaster relief conference was held in Battle Creek, Mich., during the fiscal year to discuss improvements in the disaster relief program. The conference revealed that the Department might be called upon to render additional assistance through the medium of communication facilities at its disposal particularly in the Western States.

In the field of personnel security there was a consolidation and refining of techniques already in existence. All sensitive positions within the Department of the Interior have been reviewed and up-to-date clearances have been issued.

The Division of Security has the responsibility for establishing a radiological monitoring program within the Department. Considerable progress was made and at the close of the year over 100 employees had been trained in radiological monitoring and considerable technical equipment has been obtained for operation and training. The Department has radiological monitoring capability in 23 States and through training during the next year this will be extended to many other areas of the country.

OFFICE OF THE SOLICITOR

Elmer F. Bennett, *Solicitor*



THE FISCAL YEAR ending June 30, 1958, continued the pattern of substantial increase in the workload of the Office of the Solicitor. During the year 145,717 matters were disposed of; 6,847 matters, a little more than 4 percent of the matters disposed of during the year, were pending at the close of the fiscal year. During the 1957 and 1956 fiscal years, respectively, approximately 140,000 and 131,000 matters were finally considered. In order to afford a better basis for appraising the volume of work in the Office, attorneys were asked to keep records, beginning in March, of the time spent in giving oral advice, in conferences, and in attendance at meetings. For the period March through June, these "intangible" aspects of the work of the Office required in excess of 26,000 hours.

One thousand seven hundred and six decisions in Indian probate cases were made during the year and the steady reduction of the backlog of these cases continued. There has been a sharp increase in appeals to the Secretary from decisions of the Director of the Bureau of Land Management. In this fiscal year there were 223 appeals as compared with 128 appeals in fiscal year 1957, an increase of 76 percent. Appeals disposed of increased from 128 in fiscal 1957 to 199 in this fiscal year. Forty-nine contract appeals were received during the fiscal year and 41 disposed of, as compared to 51 received and 39 disposed of during the preceding fiscal year.

There was a significant reduction in the backlog of inventions upon which the Department may seek patent protection. Twelve patents were secured for inventions developed in the course of the Department's operations. One of these covers a process for control of sea lampreys by selective poisoning of sea lamprey larvae in the spawning streams. Another covers a device for diverting fish from the water intakes of powerplants and irrigation systems. Nineteen patent applications covering inventions arising out of the Department's activities were filed in the United States. Due to the inter-

national character and importance of the work, applications relating to the control and elimination of the sea lamprey in the Great Lakes watershed were also filed in Canada.

The number of requests from Congress for reports on legislative proposals continues to grow. At the close of the 85th Congress 1,580 requests had been received. During the 84th and 83d Congresses, respectively, 1,373 and 1,137 requests were received.

The fiscal year saw the resolution of a long-standing dispute between allottees of electric power generated at Hoover Dam and the Government as to whether credits for interchange energy stored in Lake Mead can be carried over from one operating year to another and whether the Government can dispose of such energy in subsequent years. A contract for the sale of this interchange energy was entered into with the city of Los Angeles and its Department of Water and Power, the Southern California Edison Co., and the California Electric Power Co.

In the field of procurement, the office of the Regional Solicitor, Denver Region, undertook a study of the structure of sales taxes, use taxes and other business taxes in the 17 Reclamation States with respect to their effect upon Government contracts for the purchase of supplies and equipment and the probability of legal liability of the Government for paying these taxes under the various statutes and underlying conditions.

Work was completed upon the treatise "Federal Indian Law" and the book issued from the press a few days after the close of the fiscal year. The emergence of the Indian tribes into the non-Indian economy was the source of increased legal work in the field of Indian affairs. Nearly a hundred memorandum opinions were prepared in the office of the Regional Solicitor, Portland Region, with respect to problems growing out of the termination legislation concerning the Klamath tribe, and that office participated in the preparation of over 200 individual findings with respect to the need of adult members of the tribe for assistance after the existence of the tribe has been terminated. In addition, the office assisted in the establishment of trusts for some 100 minors.

There follows a list of some of the important cases concerning the activities of this Department decided by or pending in the courts during this fiscal year and of some opinions and administrative decisions. Cases of particular interest to the Bureau of Reclamation appear in the report of the Commissioner of Reclamation for this fiscal year.

William v. Lee (No. 811 U. S. Sup. Ct.). This case arose when a trader on the Navajo Indian Reservation sued an Indian in an Arizona court to collect for merchandise sold to the Indian on credit. Pursuant to judgment and writ of attachment issued by the State court, the

sheriff came on the reservation, attached and sold a herd of unrestricted sheep. The Supreme Court of Arizona held the State courts had jurisdiction over the subject matter of the suit, but that the writ of attachment was invalid because the matter of disposition of the sheep was covered by regulations of this Department, with the result that the Government had preempted the field, leaving the State no authority to order disposition of the sheep. The Supreme Court of the United States has granted a writ of certiorari on the question of the authority of the State court to exercise jurisdiction with reference to the debt.

Anderson v. Britton (Ore. Sup. Ct., 318 P. (2d) 291). In this case an enrolled member of the Klamath Tribe challenged the jurisdiction of the State court in which he had been tried and convicted of murder and attacked the constitutionality of the act of August 15, 1953 (Ore. Stat. 588) vesting criminal jurisdiction over Indian matters in the State. The Supreme Court of the State of Oregon sustained the constitutionality of the statute and the United States Supreme Court denied certiorari (356 U. S. 962).

McKenna v. Seaton (No. 14095, Ct. of App., D. C. Cir.). In this case the court sustained the action of the Secretary in permitting applicants for acquired lands oil and gas leases to comply, without loss of priority of filing, with the regulation requiring applicants to identify their holdings in other leases.

In re Southwestern Power Administration (Fed. Power Com. Docket Nos. IT-5971 and E-6407). The Federal Power Commission was requested by the Department to determine that certain rates in a long-term power disposal contract were no longer effective and applicable because, in the Department's view, such rates had been beyond the statutory authority of the Secretary to establish and of the Commission to confirm and approve. The Commission declined to act on the ground that it lacked jurisdiction because, in its view, it had been delegated no power to adjudicate the validity of an earlier action.

Wearde Construction Corporation (Bd. of Contr. App., 64 I. D. 376). A clause regularly used by the Bureau of Reclamation, which reserves to the Government the right to suspend construction work and states that this "right to suspend the work shall not be construed as denying the contractor actual, reasonable, and necessary expenses due to delays, caused by such suspension" was not intended to entitle administrative relief to be given, but to safeguard any right which the contractor might have for judicial relief.

Barnard-Curtiss Company (Bd. of Contr. App., 64 I. D. 312). Although a contractor who had not been negligent in the conduct of its operations in rehabilitating an existing irrigation system could

be required to repair damage to the work caused by a heavy rain-storm, the scope of its obligation to repair the damage, while not so narrow that the contractor could not be required to do any work that was outside the pay or neat lines, was not so wide that it could be required to restore any property of the Government that may have been damaged by the storm.

M-36457 (64 I. D. 273). The Secretary of the Interior lacks statutory authority to permit individual holders of excess lands in the Kings River Conservation District to pay the reimbursable costs administratively allocable to those holdings and thereby be relieved from the limitations on supplying water to excess lands.

TECHNICAL REVIEW STAFF

John B. Bennett, *Director*



THE TECHNICAL REVIEW STAFF assisted in coordinating the activities to carry out the Secretary's responsibility under the act of August 13, 1954, as amended, the Klamath Indian Tribe Termination Act. During the year an appraisal of tribal properties was completed; an election was held to determine the desire of each enrolled Indian whether to remain in the tribe or to have his interest in the property converted to cash and paid to him; and a plan of management was prepared for the remaining property.

The TRS coordinated the preparation of a 90-page report to the Chairman of the Senate Committee on Interior and Insular Affairs concerning the report "Federal Timber Sales Policies" of the Subcommittee on Legislative Oversight Function. One of the recommendations was for uniform timber sale regulations for the Bureau of Land Management and the Bureau of Indian Affairs of this Department and the Forest Service of the Department of Agriculture. A special task force was organized by the two Departments for the purpose of reviewing the timber sale regulations presently in force by the three bureaus. The task force report indicated that it would not be possible to establish uniform timber sales regulations immediately, due to varying statutory requirements. It was agreed, however, that future changes in regulations proposed by one bureau would be reviewed by the other two prior to promulgation, and that every effort would be made to work toward comparability of the regulations.

The TRS continued to coordinate the Department's forest and range fire control and forest insect and tree disease programs. During 1957, 5,220,070 acres of Federal and Indian lands were burned over, compared with approximately 600,000 acres in 1956 and a 10-year average of around 900,000 acres. The increase was due almost entirely to the severe fires in Alaska. In the calendar year 1957 the National Park Service, Bureau of Land Management and Bureau of Indian Affairs collectively destroyed 1,402,356 acres on 34,722 acres.

or the control of white pine blister rust. Considerable difficulty has been had with the control of the Southern pine beetle in the southern Appalachians, and considerable damage has been created within the ponderosa pine stands of the Southwest by the dwarf mistletoe. Plans are being developed to bring under further control these forest pests.

The TRS continued to give supervision to the technical aspects of the Department's real estate appraisal program with emphasis on appraisal training. A draft "Real Estate Appraisers Handbook" for use within the Department has been prepared. This Handbook outlines the Department's appraisal policies, general standards, and basic appraisal procedures, emphasis being given to the types of real property appraisal problems most commonly dealt with by the several bureaus of the Department.

The TRS assembled, for Secretarial transmittal to the House Committee on Government Operations, a report on the value of Federal lands administered by the Department of the Interior and of the value of minerals on the Federal lands.

Two members of the Technical Review Staff are engaged full-time in defense mobilization activities. They have continued to represent the Department as principals or alternates on various interagency groups developing defense mobilization plans. They also provide staff support to the Assistant to the Secretary (Defense Activities) in coordinating certain aspects of the Department's defense functions and programs. Included in the groups on which these staff members have been serving are the Mobilization Plans Group, the Interagency Planning Group of the Office of Defense and Civilian Mobilization, the Industry Evaluation Board, the Interagency Committee on Essential Survival Items, and the Interagency Advisory Committee on Essential Activities and Critical Occupations. As in previous years, the TRS has assembled, for Secretarial transmittal, quarterly and annual reports to the Joint Committee on Defense Production, prepared by offices of the Department carrying on activities under the Defense Production Act.

Other members of the TRS also participated in performance of defense functions. One member serves as Staff Assistant for Supply in the Office of Minerals Mobilization, coordinating the preparation of reports to the Assistant Secretary and the Office of Defense and Civilian Mobilization. During the year ended June 30, 14 such reports on various metals and minerals were prepared. A member of the staff represents the Department on the National Rural Fire Defense Committee. The Technical Inter-Agency Power Group, headed by a member of TRS, conducts studies to evaluate the adequacy of electric power under mobilization conditions. The group

includes representatives from the Office of Defense and Civilian Mobilization, Departments of Defense and Commerce, and the Federal Power Commission.

There was encouraging progress in over-all accomplishments in the soil and moisture conservation program of the Department, which is coordinated by the TRS. Although slightly below the 20-year schedule, all bureaus received increased appropriations during the past year, but as a result of increased construction costs and other factors, it is anticipated that the lag may be greater in the next fiscal year. Increased emphasis has been placed on the watershed concept of planning and development of the program and to this end interdepartmental as well as intradepartmental cooperation and coordination has been encouraging. Changing conditions and availability of more accurate data require that the Department conduct a constant reassessment of the 20-year program.

The efforts of the Technical Review Staff in coordinating the discharge of the Department's responsibility under Public Law 561 concerning weed control and small watersheds have been increasingly effective.

On the basis of recommendations in reports by the Technical Review Staff, the Secretary instructed the Bureau of Reclamation to construct an inlet from the main stream of the Lower Colorado into the Topock Marsh in the Havasu National Wildlife Refuge, in order to freshen the water to encourage aquatic growth valuable for migratory wildfowl, and directed that homesteading of reclaimed lands lying in the Lower Klamath and Tule Lake National Wildlife Refuges, Oregon and California, be deferred to provide food for migratory wildfowl there.

Continuing operations of the TRS include the provision of Departmental liaison with the field committees; with the Bureau of the Budget on coordination of statistical standards and programs; of surveying and mapping; with the National Science Foundation and with other Federal agencies on program matters of mutual concern. The TRS also provides central staff services in connection with the coordination and direction of the Department's participation in international activities.

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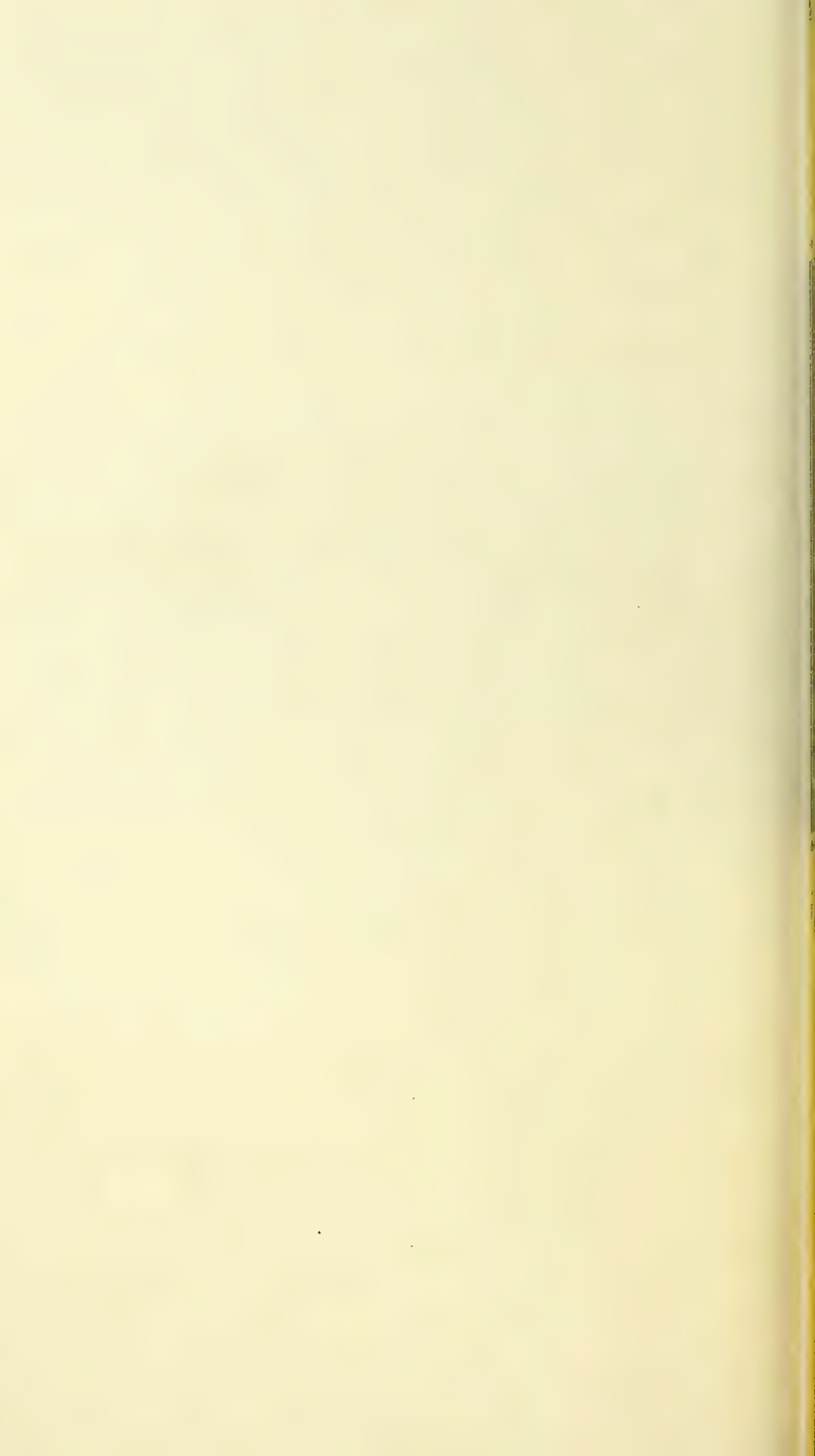
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1959 ANNUAL REPORT



SECRETARY OF THE INTERIOR

FRED A. SEATON



FOR THE FISCAL YEAR ENDED JUNE 30, 1959

*Resources for a
Growing Population*

1959 ANNUAL REPORT

SECRETARY OF THE INTERIOR

FOR THE FISCAL YEAR ENDED JUNE 30, 1959



Resources for a Growing Population





THE SECRETARY OF THE INTERIOR
WASHINGTON

DEAR MR. PRESIDENT: It is a pleasure to transmit to you the annual report of the Department of the Interior for the fiscal year 1959. This summary of departmental activities has been prepared in the hope that it will serve the cause of sound conservation and development of our natural resources by increasing public knowledge and understanding of this important area of the Nation's responsibilities. Particular emphasis is given in part I of this year's report to the challenge presented in assuring an adequate resource base for our growing population.

Sincerely,

Fred A. Seaton

Secretary of the Interior.

THE PRESIDENT
THE WHITE HOUSE

United States Department of the Interior



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PART I

RESOURCES FOR A
GROWING POPULATION



Resources for a Growing Population



EARLY AMERICA was a land of seemingly limitless plenty. Its great plains were richly productive, its rivers and streams teemed with fish, its forests were timber-laden, its mountain ranges held vast mineral treasures. If, at times, our fathers and forefathers were wasteful of these precious natural resources, there were always more trees to be cut, more land to be tilled, more deer and quail at hand for the hunter, more fuel near at hand for the taking.

But as the passage of time brought great population increases— together with an ever higher standard of living—it became evident that we could not continue indefinitely to deplete the Nation's natural resources without in time facing serious consequences.

Consequently, the wise concept of use without abuse came into being through the inspired leadership and vision of men such as Theodore Roosevelt and Gifford Pinchot, our pioneer conservationists. This concept—coupled with a sober sense of responsibility toward future generations—has saved many of America's priceless resources from destruction.

Public Attitudes Still Vary

Today, with population gains reaching ever more dramatic proportions, public attitudes still vary between the extremes of those who complacently believe that our resources are inexhaustible—and those who feel that American living standards, caught in the crush between expanding population and a fixed resource base, must inevitably decline.

Actually, neither the view that our land, water, mineral, timber, wildlife, and recreational resources are without end, nor the possi-

mistic prediction of eventual resource poverty, is sound. The first ignores the dangers inherent in unrestricted and unplanned use of resources, while the latter fails to consider the dynamic influence of science, technology, and human enterprise.

Looking Ahead

The Department of the Interior, as the Federal Government's principal agency in the field of natural resources, is fully aware of the impact of population pressures on America's natural resource base. But it is the Department's conviction that sound conservation, wise use, and orderly development of our resources will insure a steadily higher standard of living not only for today's citizens but for the multiplying millions of future Americans.

Nevertheless, the achievement of this objective will require the best thinking and planning of the Nation as a whole in the decades ahead. In this process, the Department will play a vital role. It faces today, and expects to continue to face, many difficult problems in carrying out its responsibilities to provide for the wise use of the priceless heritage represented by our abundant natural resources.

How Many Americans?

During the first half of this century, population in the United States doubled—from about 75 million in 1900 to over 150 million by 1950.

Estimates for the future take into account a continuation of the high rate of annual increase which has characterized the years since World War II. Since 1946, we have seen the population expand by some 38,000,000 Americans—more than the entire population of the Nation in the 1860's.

At the present time, our population is being increased by 1 person every 11 seconds, 330 every hour, 8,000 every day, a quarter of a million every month. Our number is now approaching 180 million. By 1980, just 21 years away, there will be nearly 275 million Americans. By the year 2000—which is only 40 years away, despite the remoteness of its sound—our present population may well double, reaching a total of 350 million persons.

Examined within the framework of these figures, the task of building from a fixed resource base to provide a peaceful, abundant life for the America of tomorrow can indeed be seen to be a staggering one.

Our Broad Fields of Endeavor

In undertaking to protect and develop our natural resources to meet the requirements of a growing population, the Department will direct its efforts increasingly in the years ahead into these four broad fields:

Research which will result in a fuller knowledge of the extent, character, and utilization of basic natural resources.

Management of renewable resources to insure full, efficient use on a sustained yield basis.

Prevention of waste in the development and use of mineral and water resources through new techniques and new programs to insure full utilization.

Preservation and enhancement of scenic, wildlife, and recreational resources which, once destroyed, can never be replaced.

On the following pages are outlined some of the problems which a growing America must face in the conservation and use of its natural resources—and the basic programs which the men and women of the Department of the Interior believe will result in finding ways to meet and solve the problems.

Water Resources

The availability of water—just plain, ordinary water—is rapidly becoming a major concern to America and to the world. In fact, as early as 1975-80, it may well be our number one domestic resource problem.

American industries, farms, and homes are today calling for an ever-rising tide of water. Presently, the Nation uses about 240 billion gallons of water daily. In 20 years, our growing population may require in excess of 600 billion gallons per day—if we have it available.

This prospect need not be one to cause alarm, but it is a matter of serious concern to the United States—one which leaves no other choice than to continue our current water conservation progress and to plan wisely and imaginatively for the years ahead.

In essence, the water problem is this: First, how do we supply a growing population and a dynamic economy with increasing amounts of water at a reasonable cost? Second, how do we, also at a reasonable cost, make certain our flowing waters are an asset to the people and not a hazard?

Only the eastern one-third of the United States has an average precipitation in excess of 30 inches. Here, our growing population will find an ample supply of water for present and for seeable needs at a reasonable cost.

In the remaining two-thirds of the Nation, annual precipitation varies from a high of 30 inches to desert areas with less than 10 inches. In these areas, water costs are moving upward in proportion to a corresponding use of available supplies. In the more arid areas which include heavily populated regions, permanent water supplies in large quantities must be transported vast distances.

The water problem is not merely one of availability but also one of quality. A considerable portion of the ground water in the southeastern coastal plain and in some Midwestern States is brackish. Some streams are extremely salty, others are turbid and muddy, many more reek with man-made pollution. For any one or a combination of these reasons, communities face water problems even in areas where precipitation is ample.

In the western United States, the principal problem is quantity and this problem is immediate, not long range. The quantity problem is further complicated by uneven seasonal streamflow, the need for regulation, limited knowledge of underground flow, and evaporation losses.

In the East, the water problem is primarily the treatment of surface water to make it usable, as well as more effective management of ground-water reservoirs.

Many areas will continue to get all the water they require from conventional sources. Water flows in wasteful abundance into the oceans from streams throughout the United States. After a century of water conservation, only about one-third of the water that courses to the sea is used in our 17 western States, and only about one-eighth of the supply in the East is put to human use.

Progress is being made gradually but steadily in capturing and using a larger percentage of this flow, but in many areas a more unorthodox, almost visionary, approach is needed to meet current and future water needs created by population pressures.

Desalting the Oceans

One day—sooner than many people realize—the United States will have to follow a new trail for its water supply, at least in certain areas. This trail leads to the inexhaustible oceans and seas of the world and to huge, known supplies of brackish water within the continental United States.

Getting the salt out of sea water is nothing new. Sailors have been doing it for centuries. Today, the crews of atomic submarines, such as the *Nautilus* and *Skate*, drink water converted by heat from their atomic reactors.

In fact, for a long time people have known how to get fresh water from the sea—by simply distilling it. Today, the Department of the Interior, through its Office of Saline Water, seeks the answer to the following question:

How can saline water be converted to fresh on a large scale at a cost cheap enough to substitute for water from conventional sources?

Water from the Sea—A Reality

Presently operated salt water conversion plants do the job with technical efficiency, but the cost is high. Sheer necessity, not competitive advantage, has caused them to be built in recent years.

On the arid island of Aruba in the Caribbean, for example, people are drinking, and oil companies are using, about 3.5 million gallons of converted sea water daily. The cost is about \$1.75 per

gallon. The oceans and seas of the world can provide an endless supply of water for increasing home and industrial use—and eventually irrigation use. The Department's saline water conversion program offers hope to solve one of man's oldest problems.



thousand gallons compared with the minimum rate of 26 cents per thousand gallons in the Capital of the United States.

In the Virgin Islands, converted saline water will be used upon completion of a conversion plant. The population there has no stripped existing supplies, and water is currently hauled by barrel from Puerto Rico at a cost of nearly \$4 per thousand gallons.

Coalinga, a small community in California, hauled its drinking water for years at a cost of \$7 per thousand gallons. Making history, the town is the first in the United States to get its water supplied from converted brackish water—at a cost of \$1.45 per thousand gallons.

Beating the Cost Problem

In many areas of America, particularly in the West, new supplies of fresh water from natural sources will surely become more expensive and the amounts available will not meet requirements. In many communities, cost curves will one day cross, and converted sea water will be the less expensive.

Of course, for some towns there is only one curve, one price, and one choice: pay the bill, suffer economic stagnation, or move on. Their water supplies are running out and no more are in sight.

The goal of the Department is to help forestall any possible water-caused local economic disasters by developing processes to make large quantities of converted water available on an economic basis. In this work, the Department enjoys the growing cooperation of private industry, research organizations, colleges and universities, and the scientists of more than 16 nations of the world.

Saline Water Program

In 1952—just a little more than 7 years ago—the saline water conversion program was authorized by Congress. In that short span of time, the curve of comparative cost has gone down further and faster than in all previous human history.

As recently as the late 1930's, it cost between \$4 and \$5 to convert a thousand gallons of sea water into fresh. Meanwhile, equipment, fuel, and labor costs have increased several fold. In spite of this, saline water conversion costs have been cut by more than half. In the most effective plants in existence, it is now about \$1.75 per thousand gallons.

The Department's program began with laboratory research. Next it included small pilot plants, and now it is about to move on to

construction of large demonstration plants. In 1959, the program waited in the wings of a new and larger stage; where, for the first time, prospects are hopeful for breaking the dollar-per-thousand-gallons barrier.

Legislative Milestone

During fiscal 1959, President Eisenhower signed Public Law 85-883. The bill as finally enacted had the support of the Department of the Interior. This new law authorized the Department of the Interior to construct and operate five saline water conversion demonstration plants.

Three will be designed to produce fresh water from the sea. One of these plants is to be located on the East coast, one on the West coast and one on the Gulf coast. Two of this group of three will be capable of producing at least a million gallons per day.

In addition, two plants will be constructed for the treatment of land brackish water—one in the Southwest, the other in the Northern Great Plains. One of these plants will have a capacity of at least 250,000 gallons per day.

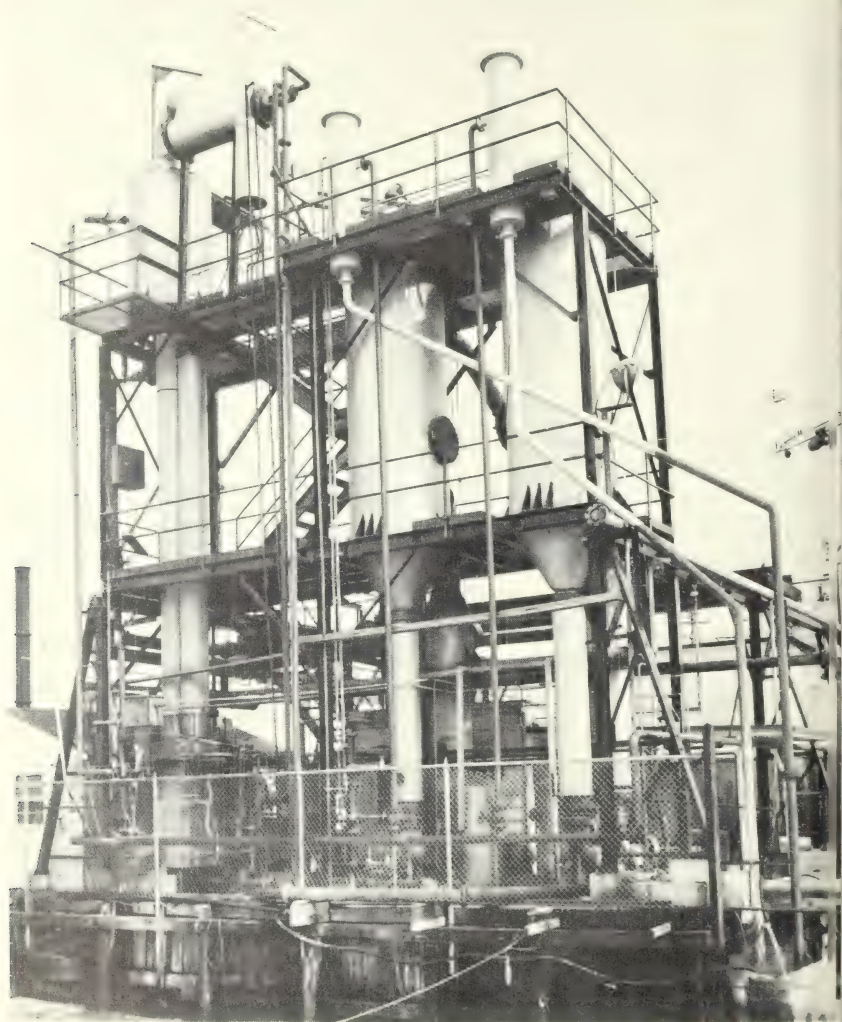
Current Progress

The first demonstration plant will use the long-tube vertical multiple-effect distillation process, developed jointly by the Department of the Interior and the late W. L. Badger of Ann Arbor, Mich. It will be constructed on the Gulf Coast at Freeport, Tex. During the past year, the Department requested funds from Congress to speed its construction.

The Department believes that potable water can be produced in this plant for less than \$1 per thousand gallons. As the size of the plant increases, it is expected that, where 15-20 million gallons per day are processed, the cost may be less than 60 cents.

The second plant will be located near San Diego, Calif., utilizing the multistage flash distillation process. For this plant, the Department is requesting the Atomic Energy Commission to supply a low-temperature, low-pressure atomic reactor as the heat source. The flash process lends itself to large-scale conversion and, with atomic energy, may open a new field for the peaceful application of the atom.

The third process, electrodialysis, will be demonstrated in a plant located either in the Northern Great Plains or the arid Southwest. Work on this and the remaining processes and plants are being pushed forward by engineers and scientists of the Department.



The long-tube vertical multiple type effect distillation process, developed in this experimental facility, was selected by the Department for the Nation's first full-scale effort to convert sea water to fresh water for municipal and industrial use.

The Years Ahead

Looking to the future, the Department of the Interior holds great hope that a key fact in human history is about to change: The fact that up to now the people of the world have depended for life entirely on fresh water upon and beneath the land.

Bearing in mind that an acre-foot of water is 325,851 gallons, the world is a long way from the day when converted sea water can be used for irrigation. That is not to say it can never be done. Once the world can not only tap the oceans for fresh water for human and industrial use—as we now can—but also for agriculture, wastelands can become gardens.

From where we stand now, we can with justification gaze toward a new horizon where arid sections of America, Mexico, the famine-cursed drought quadrangle of Northeastern Brazil, the vast unpopulated expanses of Africa, Saudi Arabia, West Pakistan, the Negev area of Israel, and Australia, to name a few, will flourish—some for the first time in all recorded history.

Bringing blessings to expanding populations in America and to millions of people around the globe, the arrival of one or more genuinely low-cost processes can well become one of the most important scientific achievements of our time.

Reclamation Progress

Despite the remarkable progress in conversion of saline water to fresh water over the past few years, the reclamation program of the Department of the Interior continues to be a vital, life-giving source of water for our 17 Western States—as it has for over 50 years.

Nor will a successful saline water program place in obsolescence the activities of the Department's Bureau of Reclamation. The bulk of the Department's water conservation program will be administered by the Bureau of Reclamation whose multipurpose projects have been conservation landmarks.

In the West, the Bureau of Reclamation has been engaged in water resource development since 1902, and the Bureau has played and will continue to play an indispensable role in the conservation programs of the Department.

In 1860, the West contained only 4 percent of the National population. By 1900, the population of the 17 Western States had increased to 11,187,961, or 14.7 percent of the National population. By 1958, the West had increased to a population of 42 million, or roughly 25 percent of our National population.

However, the fact that the area has been able to develop sufficient water to permit this rapid growth is no cause for complacency for the future. In fact, Western municipal and State officials are greatly concerned about future water needs, because they are well aware that the closest and cheapest sources of water already have

been utilized. Virtually every major water project now being considered in the West is complex and costly in comparison.

This steadily increasing demand for water underscores the importance of engineering and economic investigations which are an important phase of Bureau of Reclamation operations.

Reclamation Investigations

Engineering and economic investigations determine the necessity for and feasibility of proposed projects. They contribute to a selection of planned projects which may be undertaken as authorized by the Congress. All large water resource projects have a rather extensive "lead time" during investigation and legislative consideration. This is a factor that must be considered in any plans for expediting water resource development to meet the demand of future generations.

Multipurpose dams of the Department are designed to meet the current and future needs of our population through water storage, power generation, flood control, fish and wildlife preservation, and recreation facilities.



The Central Valley project, for example, was conceived by the State of California more than 30 years ago. The Federal Government undertook construction of the project in the thirties and the big Shasta Dam was built just before World War II. Construction was resumed after World War II ended and the \$800 million project is now more than two-thirds completed. The great Central Valley project will help control flood-rampaging rivers, store water and transport it in river-sized canals for use by municipalities, industry, and agriculture in a 500-mile-long valley. Project power-plants will generate nearly 1 million kilowatts of hydroelectric power, and its reservoirs and canals will yield other major public benefits in fish and wildlife propagation and new recreational facilities.

The Pick-Sloan plan for flood control and water development in the Missouri River likewise was conceived in the thirties, and initial features were authorized in the Flood Control Act of 1944. Fifteen years later, \$478.6 million had been expended toward construction of the reclamation features for this 10-State development, and additional millions had been invested in flood control-navigation structures built by the Corps of Engineers, U.S. Army, on the main stem of the river. As of June 30, completed Bureau of Reclamation facilities of the Missouri River Basin project will provide full irrigation to 152,000 acres, supplemental irrigation to 50,000 acres, a power generating capacity of 126,200 kilowatts, and partial flood control on several main tributaries of the Missouri River.

Similarly, the Colorado River Storage project, authorized in 1956, is under investigation for a quarter century, and will require between 30 and 50 years to complete the ultimate project. This great comprehensive project will store and transport water for consumptive use in a four-State, semiarid area larger than New England, and its multiple man-made "lakes" will contribute major fish and wildlife and recreation benefits. Water released from storage reservoirs will generate needed power for the area in hydroelectric power-plants with a total capacity in excess of 1 million kilowatts. About one-tenth of the Bureau's personnel are engaged in project and drainage basin investigations and advance planning. Included among the more than 100 proposed projects under active study are comprehensive investigations into the optimum development of land and water resources in 11 river drainage basins. Statewide water resource development studies in Texas and Alaska also are being conducted by the Bureau of Reclamation, in cooperation with other Federal agencies.

In the decades ahead, these and other multi-purpose water resource projects will help to provide essential water in areas of

mounting population in our 19 Western States, including Alaska and Hawaii.

Current Work

In the arid Western area served by the Bureau of Reclamation some 73 projects and units are currently under construction. Many of these projects, construction is virtually completed or far enough along so that the water development program is essentially complete or partially in operation. When completed, the projects now under construction will provide facilities to bring irrigation water to an additional 1,717,000 acres of land, bringing the total area which can be served from Bureau of Reclamation facilities to 9,906,000 acres. Construction is under way on 12 power plants that will have an ultimate installed capacity of 1,225,000 kilowatts, increasing the total in plants built by the Bureau of Reclamation to 6,346,150 kilowatts.

Water for Cities and Industry

Since the early days of reclamation, the important multipurpose aspects of providing water for municipal and industrial purposes have been recognized by the Congress culminating most recently when President Eisenhower signed the Water Supply Act of 1956, Public Law 85-500.

This act provides authority for the Corps of Engineers and the Bureau of Reclamation to make provision for storage not only for immediate but also for future water supply needs in connection with Federal multipurpose projects, thereby permitting the Federal Government and local interests to share equitably in the benefits of multipurpose construction.

The principle is established that storage for future use may be included in any reservoir project, planned or to be planned, constructed or to be constructed. The act is intended to provide the additional means whereby anticipated future municipal and industrial water supplies may be developed to ensure the most effective and economical use of water resources for current and future generations.

Water for Agriculture

Throughout the 57-year history of the Department's reclamation program, water has been put to work to meet the growing food demands of an expanding population.



rough the Department's reclamation program, storage of spring water
off in the rocky desolate areas of the West provides irrigation water
les away for the cultivation of nonsurplus foods to feed our expanding
population.





Byproduct electric power of the reclamation program sings through transmission lines toward growing cities for home and industrial use.

Since 1906, cumulative crop value has exceeded \$14 billion, nearly three times the total of the Nation's entire reclamation investment. In 1958, the latest year of record, the value of crops harvested on reclamation lands totaled \$987 million, some \$36 million higher than the 1956 record crop year.

While reclamation facilities have been doubled since 1940, total crop value during the same period multiplied nearly ninefold. The vast bulk of irrigation-based agriculture has, over the past few years, been concentrated in specialty crops of high commercial value—unsubsidized by the Federal Government.

In the years ahead, growing demand for agricultural products such as fruits, table vegetables, and nuts will be met increasingly from farms which owe their existence to an adequate, dependable water supply provided by reclamation facilities of the Department of the Interior.

Water Promotes Progress

The contribution of irrigation to the growth of local areas can be seen in an economic study completed by the Bureau of Reclamation in fiscal 1959 showing how reclamation promoted the growth of farm-associated industries in the Columbia Basin Reclamation project in central Washington.

The study, entitled "Growth of Agricultural Processing and Marketing Facilities," points up the following economic benefits in the first few years of an irrigation project where a single crop economy was supplanted by diversified agriculture of high-demand, high-value crops.

The marketing and processing of 50 different crops, worth \$24 million in 1957, has resulted in widespread local business expansion. Sixty-four new plants costing \$17 million have been constructed. Plant payrolls in spite of automation in modern processing increased the equivalent of 750 man-years and \$3.1 million in wages. Rail shipments to and from the project increased 40 percent, and truck shipments increased 275 percent between 1952 and 1957. In 1949, fully 99 percent of the crop shipments from the project area consisted of small grains, most of which were in surplus. By 1954, 99 percent of the crop shipments were nongrain products. Livestock feeding and slaughtering and dairying also showed a marked increase.

Economic studies also were published on the accomplishments of reclamation on the Kittitas Division of the Yakima project in Washington State, and of the Lower Yellowstone project in Montana and North Dakota. The Kittitas study disclosed that this project had produced in additional Federal tax revenues since 1940 a total of \$11,400,000—a sum greater than the cost of construction. In addition, area farm production was increased 84 percent, or \$5 million annually; retail trade increased 57 percent, and farm value increased an average of \$13,000 per farm unit.

On the Lower Yellowstone project, Federal tax revenues since 1940 are nearly double the cost of the \$4 million project, which is now 65 percent paid for by its local beneficiaries. Retail sales in the project area are four times as great as in the nonirrigated area, and project irrigated land outproduces adjacent nonirrigated land about six times. Barley and oats are the principal crop on the nonirrigated land area, while the irrigated farms produce a large acreage of sugar beets and other crops which contribute to a thriving livestock feeding operation. Personal income in the project area is about five times greater than in the surrounding nonirrigated area, potentially as a result of the irrigation of roughly 4 percent of the land area.

Reduction of Water Losses

An estimated 11.5 million acre-feet of water—more than is stored behind Grand Coulee Dam—is lost each year through evaporation from the lakes and streams of the West. Department scientists in cooperation with other Federal, State, and local agencies, are seeking new methods of making water resources fully useful.

The first large-scale research into the use of monomolecular “chemical shield” to reduce evaporation on large reservoirs was conducted during the year by the Bureau of Reclamation, in cooperation with other Federal, State, and local agencies. The tests, conducted at Lake Hefner near Oklahoma City, indicated that savings of 9 percent in water losses from evaporation were achieved under difficult conditions during tests extending over a period of nearly 3 months. Cost of the water saved was approximately equal in value to untreated municipal water to Oklahoma City. Additional research and field tests may lead to improved procedures and lower unit costs.

Progress also was made during the year in research into the control of water-stealing phreatophytes. These economically useless weeds, shrubs, and trees waste over 25,000,000 acre-feet of water each year, enough to more than fill Hoover Dam's Lake Mead and several lesser reservoirs. For example, considerable remedial work has been done in the middle Rio Grande, where a saving of more than 300,000 acre-feet of water was accomplished between 1951 and 1958. This cooperative Federal-State project to remove water-wasting salt cedars will continue, and when completed, is expected to save over 100,000 acre-feet of water annually. This is but one example of how millions of dollars are being saved and will be saved throughout the West through various methods of water conservation developed by the Department.

Water for the Future

In many ways—from desalting of ocean waters to weed eradication programs—the Department of the Interior is working constructively to meet the water needs of future generations of Americans.

Water is the most familiar and the most important of our natural resources. No individual can live without water, no nation can outlast its available supply, and no civilization can grow beyond its capacity to store and utilize water.

Growth—both in terms of population and prosperity—is certain in the United States. Whether such growth is sustained and whether

the American of the future lives a full, abundant life, depends to a great degree upon our wisdom, foresight, and efforts today to provide adequate water in the years to come.

Land Resources

At the time of the first census in 1790, the total population of the United States was 3,929,214. Today, the population of the United States is nearing 180 million and is increasing at the net rate of 1 person every 11 seconds.

Since 1790 the land area of the United States has grown by about our times. Population has increased by approximately 45 times. In the years ahead, population growth may raise the United States census count to more than 250 million by 1980 and to 350 million by the year 2000.

Since the first land patent was issued by the Federal Government in 1788, the public domain has been a source of lands and resources for our growing population and productive economy. Today, the Department's Bureau of Land Management is working to assure the Nation of a continuing contribution to national growth from the public lands.

Of the original public domain, covering about 1.8 billion acres, over 1 billion acres have now been transferred to private and local government ownership. Of the remainder, the Bureau of Land Management is responsible for administration of about 475 million acres, mostly unreserved and unappropriated.

Lands for Our Growing Population

More people require more land—America's expanding population needs land for homes, farms, and factories; land for towns, for cities, highways, and recreation.

In the West, where most of the public domain remains, land needs will probably reflect the fact that the Western United States is growing about three times as fast as the rest of the Nation. Over half of the population increase in the West since 1940 has been the result of people moving west, and an important portion of future land needs in the West will be met from the public domain. The expanding dimensions of the Nation's urban areas, as the cities sprawl further and further into the rural hinterland, are creating new demands upon public lands in many areas of the West. In California, in Nevada, in Arizona, and New Mexico, cities are reaching out to embrace public lands formerly valuable only for grazing and stockraising.

Another urgent need is land for recreational development. In carrying out its land program the Department is cognizant that special emphasis needs to be placed on the satisfaction of local, State and National recreational land needs.

New Land Concept

New legislation to permit planned urban and suburban development has been requested. The proposed law would make possible the application of the first new concept in public land disposition since passage of the Small Tract Act in 1938, by authorizing development of areas up to 1,280 acres by private companies and local government.

Also, total supply of public land for private and public use is in effect, being enlarged. Old, obsolete, or inefficiently used lands, withdrawals and reservations are being reviewed. Some withdrawals are being reduced in size to reflect actual need for land. Other unnecessary withdrawals are being eliminated entirely.

Requirements for public lands for public purposes are being met by a wide variety of program elements. Land for wildlife conservation is receiving particular emphasis. New arrangements for balanced multiple use of public lands are broadening the base of land use.

As new demands are made on the public land base, it will be increasingly necessary for the Department to manage the public land wisely and assure balanced, harmonious use and development in the light of the long-term needs of the American people.

Before Development—Surveys

In the past, long before people and progress came to an area, public land surveyors of the Department's Bureau of Land Management laid out the familiar checkerboard of sections and townships.

Now, however, present-day needs no longer allow the time necessary for full surveys before all settlement and development. The new State of Alaska is a good example.

When Alaska became a State in January 1959, it received a land grant from Congress totaling 103,350,000 acres. The exact lands which the new State will receive were not spelled out in Statehood legislation; rather, Alaska will have 25 years to select land from the public domain. The exterior boundaries of all these lands (in tracts usually at least 5,760 acres) must be surveyed and the boundaries of land claims inside selected tracts also will have to be surveyed.



most public lands suitable for homesteading have already been settled, except in Alaska, but the public domain still provides land for suburban use for 2- to 5-acre permanent or vacation homesites.

If all of the Alaskan grant lands were in a single, compact circle, the task of surveying the exterior boundary alone would be approximately equivalent to surveying a line from San Francisco—across California, Nevada, Utah, Colorado, and Nebraska—to the Mississippi River at Omaha.

Applying Modern Techniques

In making this and other surveys, the Bureau of Land Management is employing the latest survey techniques and equipment in its geodetic survey operations.

Electronic measuring devices are speeding the computation of distances. Expert photogrammatists are applying the skills of precision aerial photography and photointerpretation to modern public land surveys. Helicopters are being used to speed survey crews to and from remote, rugged work areas.

To speed the development of resources and to permit many types of exploratory operations, the Department has begun an extension of the rectangular survey system by protraction over the remaining unsurveyed areas. This means sketching out the form of the public land survey grid by drawing lines on paper instead of laying out the boundaries on the ground. Protracted surveys will serve as the temporary basis for oil and gas leasing and many other land management activities until the lands are later surveyed on the ground.

To meet the growing needs for home and recreation sites, particularly in California, large areas are being surveyed and subdivided into small tracts.

Forest Products for Our Growing Population

No resource can demonstrate more clearly the need for planning for tomorrow's people than our forests. With a growth and harvest cycle that may span two to four generations, forest conservation today will determine the volume of the forest crop for many years in the future.

Altogether, the Department's Bureau of Land Management administers some 161 million acres of forest land, including about 10 million acres of commercial forest lands.

Forest production and harvest from BLM lands is done under the scientific principle of continuous sustained yield by harvesting the annual replaceable forest growth without borrowing from the growth stock needed for future generations.

BLM forestry programs have an important impact on many local areas. More than 10,000 man-years of local employment are provided by this program annually. The end-product value of

Sustained yield timber management on public domain lands provides a constantly renewing supply of timber for our growing needs.





Multiple-use of our public lands, such as the O. & C. lands in Oregon shown above, provide mineral and forest resources, wildlife habitat, and recreational facilities to meet the requirements of an expanding population.

Timber harvest amounts to tens of millions of dollars in contribution to the local and national economies.

The Department's forestry program on public lands must, of necessity, take into consideration all aspects of resource conservation—timber production under sound methods; protection from insects, disease and fire; watershed management; recreational use; wildlife enhancement; grazing; and mineral production.

Creating New Forest Resources

Idle and unproductive forest land must be put to use to help meet future timber needs. Today BLM is seeding and reforesting areas that were formerly unproductive at an annual rate nearly double the previous 20-year total.

The amount of timber taken from each acre is now about double that taken from a comparable area 20 years ago. Losses from fire, insects, diseases and delayed regeneration are now much below that of the past two decades.

The completion of forest resource inventories is raising the annual allowable cut. New access roads are opening up virgin areas for intensive forestry. Under competitive bid sales, the Department markets over a billion board feet of timber annually from BLM lands—enough lumber to build nearly 100,000 average homes every year.

Minerals for Our Growing Population

The continual development of the resources on our public lands will help provide the expanding population with minerals and fuels necessary for a vigorous, growing economy.

The public domain lands contain a substantial part of the Nation's raw energy materials—oil, gas, coal, and nuclear fuels. In order to meet the future demand for energy, the production of mineral fuels will have to be doubled by 1975 and possibly doubled again by the year 2000. Exploration and development on the public domain will help meet this staggering increase.

Uranium, the raw material of nuclear power, will in the future be put to large scale commercial and industrial use. Known uranium resources will probably more than meet the needs of the free world for the next few decades. Uranium exploration has so far been confined principally to surface exploration, and subsurface exploration may multiply known resources many times.

Under the Mineral Leasing Acts of 1920, the General Mining Laws of 1872, and the Outer Continental Shelf Lands Act of 1953, the Department of the Interior carries on mineral development and conservation programs. Revenues to the Federal Government from these operations have totaled hundreds of millions of dollars.

Range Lands

The long-term goal of the Department's Bureau of Land Management range resource program is to rebuild the public domain range land to its full productive capacity. Today, the downward trend in range condition has been stopped on more than four-fifths of the lands that were deteriorating at the time of the Taylor Grazing Act in 1934. At the same time, Federal grazing lands are being put under effective permanent sustained yield management.

The task of restoring and rebuilding the Federal range will take years, but measurable progress already has been made. For example, on a million acres of artificially seeded public range, beef production has been raised from an average of 2 to 3 pounds per acre to 40 pounds per acre.

The long-term methods by which the Federal range will be brought up to full productive capacity involve construction of a wide array of range improvements—fencing, watering holes, storage tanks, and spring development. It will also involve seeding millions of acres of presently unproductive lands, substituting good forage for wildlife and livestock on millions of acres of lands now infested with low value forage plants and noxious weeds.

Wildlife management and conservation, along with other multiple range land uses, are integrated into patterns of grazing land use that are geared for the full productivity necessary to meet the growing needs of America's mounting population.

Mineral Resources

Population growth in the United States inevitably means an enormous drain upon our Nation's nonrenewable mineral and fuel resources. Coal, oil, and natural gas in ever increasing quantities will be needed to supply our energy requirements, while increased output of mineral resources will be necessary to supply the growing "hardware" needs of our civilization.

One thing is certain: More people in the United States will consume more mineral and fuel resources in the years ahead than in any previous period of our history.

It is estimated that per capita consumption of mineral products will increase by 40 percent by 1975. In the same period, we can reasonably assume that the rate of mineral and fuel consumption will be more than double the rate of population growth.

Mineral Interrelationships

If the relationship between minerals consumption and population were a direct one, it would be simple enough to look ahead to predictable levels of consumption of various mineral and fuel commodities. But such is not the case. The amounts of mineral raw materials consumed are dictated by other factors that are sometimes of greater significance than the number of consumers.

We have entered into a civilization based upon rapidly changing technology of increasing complexity. The replacement of human labor by machines and refinements that make our standard of living a thing of marvelous mechanical intricacy are all contributing to new and varied demands for specific commodities.

At the same time, the economics of production and utilization of these commodities have made competition among commodities a matter of very real significance. The substitution of one mineral or

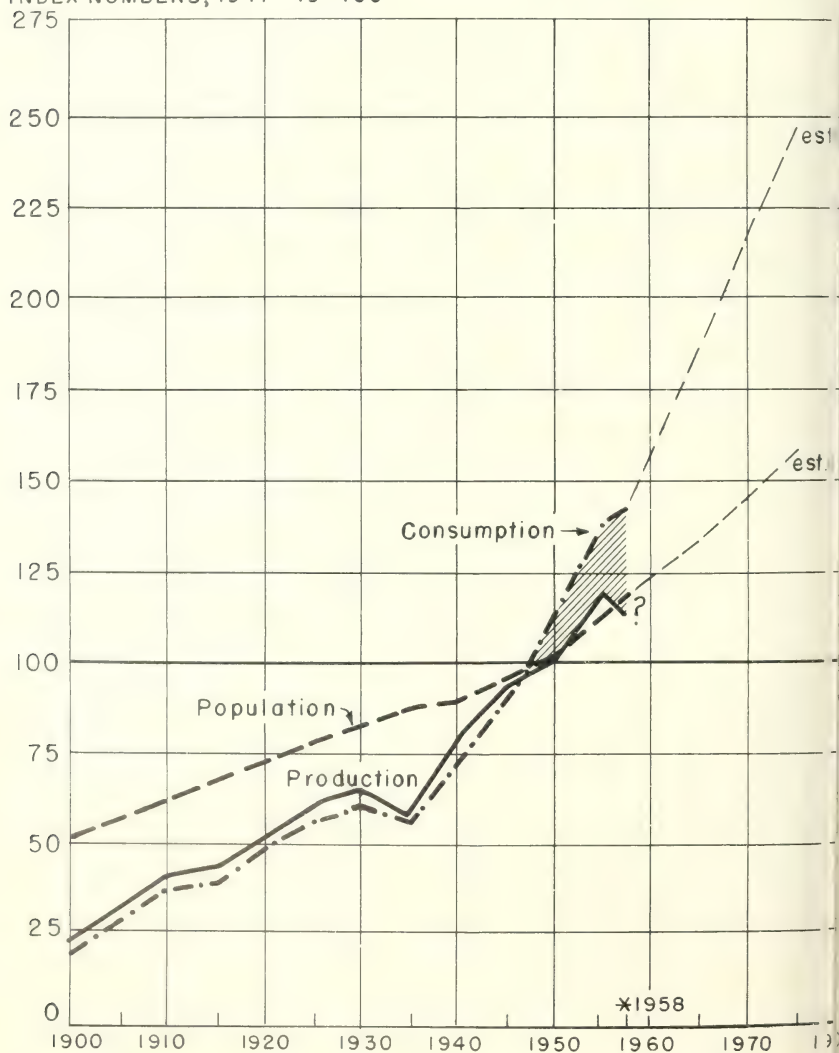
metal or nonmineral material for other mineral resources also continually felt by the producers of minerals and fuels.

Population Not the Only Factor

Population growth alone is not enough to measure the future demand for minerals and fuel resources.

THE MINERALS PROBLEM TO 1975

INDEX NUMBERS, 1947-49 = 100



SOURCE BUREAU OF MINES

The per capita consumption of aluminum, for example, has increased many times in the past 10 years while the per capita consumption of copper has increased only modestly. It cannot be denied that the increase for copper would be much greater were it not for competition from aluminum.

Consumption of plastics and glass has increased at the expense of such materials as tinplate, and in turn, plastics have won markets from glass in the container industries. The prime historical example, of course, is the interaction of coal and petroleum and natural gas in satisfying our fuel requirements.

Consumption Outstrips Production

Although domestic production of minerals has increased markedly, it has not kept pace with the increase in consumption after World War II. Since 1900, consumption has increased by a factor of 7.5—production, by a factor of 5.5. The figure on opposite page illustrates the gap between production and consumption that is forever widening. In the late 1940's, this country became a net importer of minerals and fuels. Since the population of the rest of the world is growing faster than our own, it is to be expected that consumption of minerals by the rest of the Free World will grow at an increasing rate for the years ahead. This will put considerable pressure on our overseas sources of supply of many minerals and intensify the problem of meeting our own rising demands.

Resources for the Future

Provision of mineral and fuel resources for an expanding population faces a series of challenges from dwindling reserves, expanding industry, and new and improved technology in other industries. Because such resources are nonrenewable, these challenges will force us to move across new frontiers of scientific knowledge in search of the solution to the ever lengthening lists of problems.

Horizons must be greatly broadened if these challenges are to be met. Thus far science and technology have learned to use only a fraction of the elements and substances that surround them in the physical world. The problems that must be solved by the minerals industries in the future will necessitate constant expansion of the sources of mineral raw materials. The ultimate goal will be achieved when means have been found to extract and utilize all elements and compounds from even the commonest and most abundantly widespread rocks, soils, waters, and the atmosphere.

The Department of the Interior, through its Bureau of Mines, provides much of the forward-looking scientific approach which is essential if we are to provide increasing supplies of minerals and fuel resources to meet growing demands.

Scientific Knowledge

The science of technology in mineral resources is necessarily coupled with scientific information concerning the discovery, appraisal, and systematic development of our mineral and fuel resources.

For the past 80 years, the Department's Geological Survey has been obtaining basic geologic data needed to supply the urgent mineral needs of our expanding population. Despite continuing effort, the need for geologic data far outstrips the rate at which data are acquired.

As the population of the United States continues to expand, the avenues for supplying basic mineral and fuel resources are available.

Discovery and development of new deposits.

Better use of existing reserves through sound conservation, improved development techniques, and wise utilization.

Mining research pioneered by the Department of the Interior has resulted in extensive open-pit mining of lower grade mineral ores to meet the requirements of our expanding population.



To meet these requirements, geologic research by the Department the mineral and fuel resource fields will emphasize: Systematic studies in areas favorable for mineral occurrence; evaluation of known and potential deposits; theoretical studies of the geologic processes that form mineral deposits; and continued research in mineralogy, petrology, photogeology, geophysics, and geochemistry to develop new and improved means in seeking mineral resources.

Mineral Exploration

New areas rich in mineral and fuel occurrence are becoming increasingly more difficult—and therefore more costly—to find in the United States.

Most of the easily found deposits have been discovered and developed, making the problem of maintaining an adequate level of domestic mineral supplies more difficult. It is essential that increased emphasis be placed on mineral discovery to meet growing needs in the decades to come.

Today, financial risks are so great that private industry, in many instances, cannot continue to search without Federal assistance for strategic or critical domestic minerals at a rate sufficient to keep pace with the Nation's mounting requirements. As a result, the Department, through its Office of Minerals Exploration, conducts a program to encourage exploration for needed minerals in the United States.

This permanent mineral exploration program in which the Department participates financially with private industry should continue to assist in developing new mineral reserves for the use of future generations.

Fuel Resources

To maintain and further the high living standards of the United States and to power our rapidly growing economy in concert with the heavy growth of our population will require the ready availability of increasingly large additional quantities of energy.

Widespread utilization of America's rich deposits of coal and its petroleum and natural gas began less than 150 years ago. The explosive growth in total energy demand in the last 50 years and anticipation of the continuation of this trend have focused increasing attention on fuel reserves, their conservation, and the evaluation of our capability for meeting the energy requirements in the coming years.

and Gas, the Bureau of Mines, and the Geological Survey, all agencies of the Department—is nearing completion.

The potential availability of petroleum in the United States seems sufficient to provide the bulk of our domestic requirements for many years. Estimates have been made that 240 billion barrels recoverable oil may ultimately be developed in the United States. In addition, tremendous reserves of oil shale exist in this country which may exceed a trillion barrels.

While these figures seem reassuring, oil conservation, intelligent development, and efficient use of our petroleum reserves are essential to meet the needs of Americans in future years. Oil, like all other mineral fuels, cannot be replaced or renewed. Once used it is gone forever, and under such circumstances there can be no justification for its use on a wasteful basis.

Our Shrinking Helium Resources

The consumption of helium has increased approximately 100 times since 1950, and today it is a valuable military, industrial, medical, and basic research tool contributing to the safety and welfare of our citizens everywhere. Unfortunately, however, while one of the most valuable of our natural resources, it is probably the scarcest.

Our known helium-bearing gas resources are concentrated within a small geographical area in the Texas and Oklahoma Panhandles and adjoining areas of Kansas. Moreover, no important new discoveries of helium have occurred in the past 15 years.

So far as can be ascertained, United States helium resources constitute the total Free World's supply. Unfortunately, continued production from known major reserves is unavoidable, because the natural gas containing helium is dedicated to commercial markets. At present we are recovering only a fraction of the helium now produced.

The helium-bearing gas fields contain about 120 billion cubic feet of recoverable helium—350 times the present annual consumption of helium in the United States. But all of these fields are being produced to supply fuel gas markets, and about 4 billion cubic feet of helium is being wasted annually when the gas is consumed in domestic and industrial furnaces. At the current rate of loss, and with increasing consumption, the presently known helium-bearing gas fields would be incapable, after 1985, of supplying enough helium to meet all of our needs.

Conservation Program Under Way

Consequently, the Department has requested legislation for a helium conservation program designed to conserve approximately 2 billion cubic feet of helium between now and 1985.

The program calls for the construction of 12 additional helium extraction plants as soon as possible to remove helium from natural gas going to fuel markets. Helium, so conserved, will be stored until needed in the Government-owned Cliffside Field near Amarillo, Texas.

It is hoped that incentives will permit private industry to finance, construct, and operate these plants to produce helium for sale to the Government. If private participation proves infeasible, however, the necessary new extraction facilities will have to be constructed and operated by the Department's Bureau of Mines.

Waste Recovery

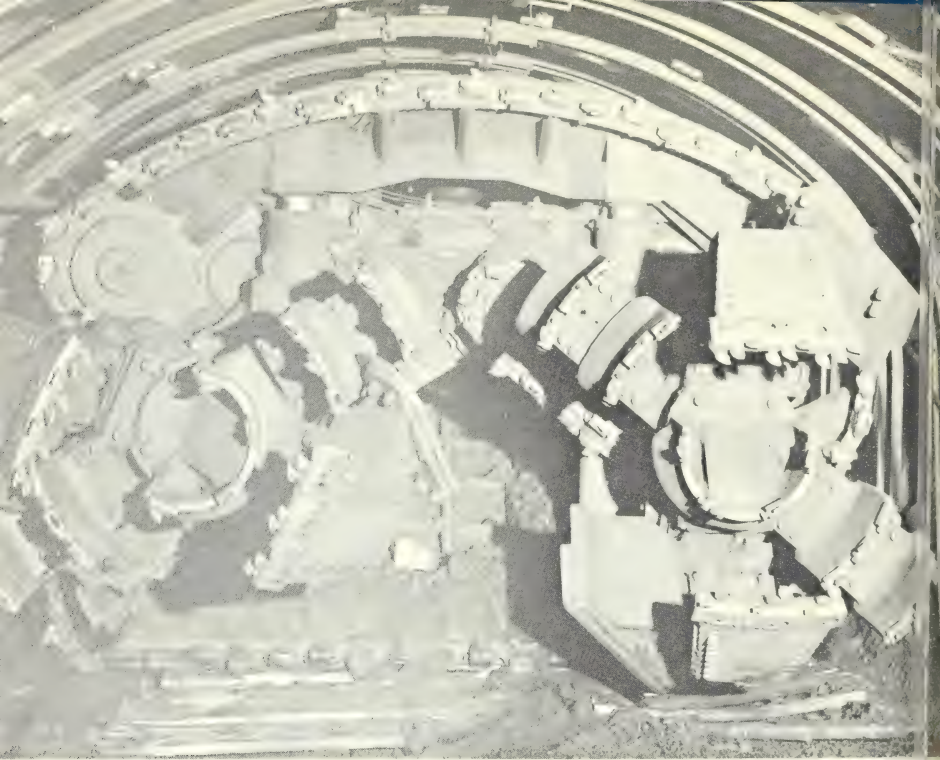
While mineral resources are not renewable there is always the possibility of more than a single use for a given supply. This comes about by recovery of scrap and reclamation of the valuable constituents it may contain. Many commodities are now being shunted to the waste pile as discards from various production processes.

Some—such as gallium—have been victims of low demand, though new uses for gallium are just now coming to the fore. Others, like furfural, are being recovered at some plants, but are being lost at others. The proper selection of material for uses can do much to conserve supplies. The use of corrosion-resistant materials eliminates wastes that come from oxidation by the atmosphere and the cost as well as the material required for protective surfacing.

Mineral Recovery

The quality of mineral resources continually declines as the best deposits are mined. One of the principal elements of Departmental research is directed particularly toward increasing production from currently submarginal deposits—those that appear likely to be called upon in the next 20 to 100 years to meet the Nation's growing mineral requirements.

Frequently, submarginal deposits are enormous in size and if economically workable would be able to fulfill large demands. Often they are not only low in desirable mineral content but have the added disadvantage of being complex and difficult to treat metallurgically.



Department research in the fields of mining techniques and equipment has led to both governmental and private development of efficient machinery to mine coal and other minerals.

A good example of the attack being made on such deposits is found in bauxite, the raw material for aluminum production. Domestic supplies of this valuable mineral are very limited, forcing the United States to import most of its high-grade bauxite from abroad. However, in Hawaii there are immense low-grade bauxite deposits which have received preliminary examination and metallurgical tests that have led to a cooperative program with the State of Hawaii to measure more accurately the potential of this huge resource.

Much more attention also must be given to improving the techniques of exploration and their wide application, for these techniques can recognize evidence of deposits that do not reach the surface. A half-billion-ton, deep copper deposit near San Manuel, Ariz., was found by Bureau of Mines exploratory drilling based on slight surface mineralization.

Coal Recovery

Coal-mining conditions in the Eastern States will inevitably become more difficult and techniques must be developed to overcome new problems in recovering coal from the ground. Although advances in mechanization and productivity have been significant,

fer and better procedures for mining and transporting coal are still needed and are being sought in the Department's research program.

In the Western States, emphasis must be placed on increased recovery to avoid leaving large quantities of coal in the ground.

Petroleum Recovery

The Department of the Interior has provided leadership through research in developing technology to increase the yield or recovery of petroleum from underground reservoirs. This means producing more barrels of oil per acre and is part of a broad conservation program that is assisting industry to supply increasing amounts of natural resources to our growing population.

Improved recovery techniques resulting from such research are increasingly important to maintain adequate proved reserves because it is becoming more and more difficult and expensive to discover new reserves. In recent years, new reserves resulting from exploratory drilling have not been as encouraging as in former years.

This does not indicate necessarily that the country is running out of oil. In fact, total proved reserves are at an all-time high, but this is due mainly to oil proven by extensions of fields and revisions of earlier estimates for known deposits. Increased recovery or yield resulting from the application of better production techniques is an important factor causing the upward revision of previous estimates.

Research was the forerunner of this favorable situation and more research will be needed to develop even better recovery techniques, so that petroleum can be produced in ever-increasing volumes to satisfy the continuing upward trend in demand that is being created by our growing population.

Extraction and Utilization

The advances of the past half century in the science of extracting mineral raw materials from lower-grade deposits have been remarkable. Just as noteworthy have been recent developments that have permitted the extraction and utilization of many of the more esoteric minerals that were unknown to commerce 25 years ago.

Department research provided the Nation with titanium, zirconium, and hafnium. In the foreseeable future, industrial supplies of high-purity metals such as yttrium, vanadium, cerium, chromium, and tungsten may become reality through research fostered and conducted by the Bureau of Mines.

Coal Utilization

To insure optimum utilization of coal and our ability to meet the needs of a dynamic society, a comprehensive coal research and development program is underway, directed toward insuring the ability of coal to retain its share of the energy market, exploring the possibility of expanding this share as other fuels become scarcer and more expensive in the years ahead, and evaluating alternative nonfuel uses of coal.

Improved preparation practices will be needed to permit satisfactory utilization of dirtier and finer-sized coals.

Although coal-derived liquid fuels are not now competitive economically with petroleum products, extensive research has indicated that their costs may be reduced. In addition, the potential application of nuclear energy to gasification of coal, as well as a study of the effects of irradiation of coal, is now being investigated.

Ways will eventually be found to use our vast reserves of low-rank lignite as effectively as coals of higher rank. Coal will eventually be the earth's most abundant source of organic compounds that will be needed for producing chemicals and pharmaceuticals. New techniques for separating, identifying, and upgrading these coal products must be, and are being, developed.

Substitutes and Synthetics

Another attack on the problem of future mineral supply is through research on substitute, alternative, and synthetic materials.

In the Department, special attention is focused on use of abundant resources as substitutes for minerals that may be in short supply. New metallurgical techniques are sought to relieve dependence of iron production on the shrinking supply of metallurgical-grade coal.

Copper may be replaced in some uses by more-abundant aluminum. Abundant anhydrite may, through research, become an economic domestic sulfur-source material.

Research on synthesis of asbestos and mica is aimed toward improving the domestic supply of these strategic materials. Such research on synthesis of nonorganic compounds may well have broader implications in relieving man's dependence on scarce natural sources for many industrial minerals. In some instances, materials are synthesized that are superior to naturally occurring minerals.

Substitution and synthesis offer many intriguing possibilities for the future. Such metals as iron, silicon, magnesium, aluminum, sodium, calcium, and potassium are available in common rocks and in the oceans in quantities that beggar our consumption requirements.

nts. Perhaps the day will come when they will become the basis of our industrial civilization instead of the traditional copper, tin, iron, lead, and ferroalloy metals.

Human Resources

The Indian people of the United States are by no means a vanishing race.

When the North American continent was discovered, the Indian population was, according to the best available estimates, in the neighborhood of 800,000 to 1,000,000. For a period of years, the Indian segment of our population dwindled, and Census Bureau records show a low point of approximately 250,000 was reached in 1900.

Today, the Indian population—both on and off reservations—is estimated to be over 550,000. Evidence indicates that the rate of population increase in most tribal groups is now higher than the growth rate for the entire United States.

In recent years, there has been increasing population pressure on the physical and natural resources of the Indian reservations. As a result, a growing tendency exists for the Indian people to look for other means of livelihood apart from the land. For example, on the Navajo reservation, the income of tribal members from agriculture and stock raising is only about 11 percent—compared with approximately 58 percent as recently as 1940.

Vocational Progress

Similar though less pronounced shifts away from the land are undoubtedly occurring in other tribal groups. In many cases, Indian families are leaving reservations to move into the mainstream of American life. In other instances, the land will no longer adequately support the growing Indian population.

This movement of the Indian people away from dependence on the land into other fields of human activity constitutes a major reason for the Department's programs to develop industry adjacent to reservations, to aid Indians who voluntarily leave their reservations, and to train Indians in skilled occupations through adult vocational schooling.

While dependence on land is lessening and the lands held in trust for the Indians constitute less than three percent of the total area of the United States, their wise use and development are of utmost importance to those who remain on tribal lands.

Human Resources

The Department recognizes that the development of human and physical resources must go hand in hand. With this premise in mind, all special programs for Indians carried out by the Bureau of Indian Affairs are focused on the development of Indian potential.

Over half of the annual appropriations made by the Congress for Indians is allocated to education programs and school construction specifically aimed at the development of Indian talents to the extent that Indians may take advantage of opportunities wherever they exist, either on or away from their reservations.

Even the underlying purpose of the resource programs carried out on Indian reservations is a human purpose—to teach Indians how to conserve, manage, and better utilize the physical resources they own.

The Department sees its responsibility to Indians as being unique—a responsibility for the development of people and the programs carried out are designed to give Indians the know-how to face the problems of modern living.

Changing Patterns

In the past most Indians were content to follow a simple way of life in cultural isolation on their reservations. This is no longer true. Indians today want better opportunities for themselves and their children; better education, better health; better standards of living; and an active part in determining their own destiny.



Developing Indian resources to meet the needs of the expanding Indian population requires increasing emphasis on education of Indian youth.

To achieve these legitimate aspirations, most Indians living on reservations must overcome two major roadblocks: (1) the imbalance between rapidly growing population and their resource base, and (2) the serious educational gap between Indian populations who have lived for several generations in cultural isolation, and the general population.

Upsurge in Education

Since education is the key to Indian advancement, the growing upsurge of Indian interest in education is most heartening. Indian parents, educationally disadvantaged themselves, are demanding better educational opportunities for their children and are learning how to participate in the management of their local schools.

Increasingly, Indian children are enrolling in school at the proper age, attending school more regularly, and staying in school longer. More and more of them are enrolling in public schools. This increased interest in education places a strain on already crowded Federal and public facilities, and makes it necessary to gear school construction and instructional programs closely to growing needs and requirements.

Indian youths in greater numbers are attending school beyond the high school level in both vocational and college courses. Federal grant programs and tribal scholarship and loan programs assist the college-bound youth, and the Federal adult vocational training program provides educational opportunities for Indian adults between the ages of 18 and 35. Special programs of the Department for educationally disadvantaged adults designed to upgrade their literacy and educational competency are well received by Indians.

No longer is the Indian satisfied to have his destiny shaped for him; no longer is he indifferent to education. In consultation with him, the Department gears its programs to his special needs and helps him develop the understandings, the skills, and the capital he needs to achieve his goals.

Land and Water Resources

Out of the total of approximately 53,000,000 acres presently held in trust by the United States for Indian tribes or individual Indians, an aggregate of about 34,500,000 acres is now being used by Indian people for the production of crops or livestock and another 9,500,000 acres is being used for the same purposes under lease or grazing permit.

To help the Indians in realizing the fullest possible income from their land and water resources, the Department carries on two main kinds of activity. First, it provides technical guidance to Indian operators in farm and range management, in soil and moisture conservation, and in the operation of irrigation projects. Secondly, it works with Indian people in bringing new lands and additional water supplies into production and in raising the available land and water resources from a lower to a higher state of use.

In this latter field, Departmental programs continue to bring desert or semiarid lands under irrigation in both old and new projects. In some cases, this means agricultural production where previously there had been none. In other instances, the change is from grazing values of a few cents per acre to cultivated crops which may be valued at over \$100 per acre.

At the same time, efforts are being launched on a number of reservations to make a complete inventory of the available resources on a basis for more comprehensive development and utilization programs.

Forests

More than a fourth of all Indian trust lands, about 14 million acres, is classified as forest and woodland. These timbered lands are an important factor in the Indian economy. They provide fuel and other wood products for local consumption; they produce forage for livestock; and, in some areas, they provide game, fish, berries, and roots for tribal use.

Six million acres of these lands, classed as "commercial" forests, are producing important cash income for the Indian owners. During the past 50 years, these forests have been consistently managed according to sustained-yield principles and have produced a harvest of 22 billion board feet of timber valued at more than \$155,000,000.

For many years, the forestry program of the Bureau of Indian Affairs was handicapped by inadequate, incomplete, or out-of-date information concerning the extent and quality of the timber growth on Indian lands. As a result, the timber was harvested in most areas on an extremely conservative rather than a full-utilization basis.

During the past decade a determined effort has been made to eliminate this deficiency. A program of forest inventories has been initiated to determine the volume, condition, and growth potential of the forests. Aerial photography and other modern techniques are being used in developing this information. As the inventory for each reservation is completed, a new plan of forest management and new cutting schedule are prepared and put into effect.

New inventories and management plans have now been completed for about 25 percent of the commercially important Indian forest lands and are under way on an additional 50 percent.

Minerals and Fuels

In comparison with other resources, the minerals in Indian lands—particularly oil and gas—have by far the greatest income-producing potential. In fiscal year 1952, the total income to Indians from oil and gas leasing of their lands was about \$19,125,000. The comparable figures for the fiscal years 1957 and 1958 were \$72,616,000 and \$55,210,000, and \$46,587,458 in 1959.

In large part, the increases have been accounted for by high bonuses offered during the past few years for leases on Navajo lands



Water conservation on Indian lands is an important aspect of the Department's program for effective use of Indian resources by Indians.

In the "Four Corners" area of the Southwest where Utah, Colorado, Arizona, and New Mexico meet. Other tribal groups, however, have also benefited from mounting interest in oil and gas leasing of their lands, and the development of uranium has added significantly to the income of groups such as the Navajo Tribe and the Pueblo of Laguna in New Mexico.

A noteworthy aspect of the Navajo development is the fact that a substantial portion of the income realized from oil and gas leasing of the tribally owned lands has been channeled into programs to make more effective use of other tribal resources.

Funds have been budgeted, for example, to construct a new saw mill on the reservation which will permit the tribe to take full advantage of the increased timber harvesting that has now been scheduled as a result of a new forest inventory.

Water resources on the reservation range have been more fully developed and a special program to train tribal members in the techniques of irrigation farming has been launched.

These are only a few of the ways in which income from mineral leasing of Indian lands has been used to benefit increasing tribal populations. In the future, if production of oil and gas measures up to expectations and brings in greater royalties, still broader programs of a similar nature will be undertaken.

Hoping to keep as much Indian land as possible in Indian ownership, the Department in 1959 recommended major amendments to S. 51, a bill dealing with the sale or leasing of land owned by two or more Indians. One change would increase the Indian Bureau \$10 million revolving loan fund to \$25 million. The additional money would be available to tribes to buy up Indian land which otherwise might be sold to non-Indians. The other amendments would give individual Indians or tribes a preferential right to purchase tract put on sale.

Territorial Growth

Economic progress in the territories of the United States is the key to improved living standards for our increasing insular population. Progress depends upon careful and sound use of available resources, attention to modern skills and techniques, and introduction of new industry.

Meeting this challenge is an important and continuing responsibility of the Department of the Interior through its Office of Territories.

In few areas under the American flag is resource development for future generations a matter of as great importance as in the island possessions of the United States. The territorial areas under the jurisdiction of the Department of the Interior total approximately 1,130 square miles of land inhabited by more than 152,000 persons—about 135 persons per square mile.

Limited Resources

The Virgin Islands, Guam, American Samoa and the Trust Territory of the Pacific Islands contain neither large land areas, significant forests, nor minerals or fuels of commercial importance. In these lands, scattered across the Pacific and in the Caribbean, natural resources that can be used for economic development consist essentially of arable land and the products of the sea.

Climatic conditions impose definite limitations on agriculture. Opportunities for diversification are few, and these island areas have passed the stage of development where the food needs of their people can be wholly met through local production. In varying degrees, each must import food and other essential commodities in exchange for the sale of local products or services.

Land Problems

Guam and the Virgin Islands, in particular, import a large part of their food requirements. In all cases, however, programs are in effect to solve technical problems and to encourage increased production of foods and commercial crops.

In the Virgin Islands, this effort is hampered by limited rainfall and the principal agricultural effort centers on sugar cane, a major commercial enterprise. The Virgin Islands Corporation—a Federal corporation that aids small farmers, purchases and grinds their cane, and raises sugar cane upon its own lands—is the prime mover in the effort to increase production.

American Samoa and the Trust Territory of the Pacific Islands rely upon copra as their cash crop. Programs are under way to increase copra production, to improve local crops, and to introduce secondary cash crops, such as cacao in the Trust Territory.

Tourism and Travel

While climate has a limiting effect upon agriculture, it has substantial compensating benefits as witnessed by the tremendous growth of the tourist industry in the Virgin Islands. Tourism has become a mainstay of the Island's economy and its further development is actively encouraged.

American Samoa may also benefit from tourism through the construction of a new airfield to accommodate jet aircraft on South Pacific air lanes. Once an important port of call on the sea lanes, American Samoa may well become an important stop for air travelers in the future.

Fishery Resources

Conservation of marine resources has been initiated in the Trust Territory where trochus shell constitutes an important source of income. Sanctuaries and harvesting seasons have been established to protect this shellfish, which inhabits the reefs. A pilot fishing operation has been started to train Micronesians in deep sea fishing and a major objective is the possible canning of fish to supply local markets that now rely upon imports. In American Samoa a deep sea fishing training program already is well under way.

Water Problems

Expanding population and economic development focus attention on the need for adequate water supplies in island areas and Department programs are giving particular attention to this requirement. For example, the Government of American Samoa and the Geological Survey recently cooperated in surveying additional sources of potable water.

In the Virgin Islands a critical shortage of potable water is faced by the Island of St. Thomas where the supply was maintained through the year only by virtually continuous barging of water from Puerto Rico. Salt-water distillation will eliminate this costly operation. Subject to Congressional review of plans, construction has been authorized of a plant to produce a minimum of 250,000 gallons of water daily with electric power as a byproduct. A contract has been signed for planning and design of the plant. The Virgin Islands Corporation will operate the facility and sell water to the Virgin Islands Government for distribution.

Continuing Alaskan Responsibilities

In Alaska, which was admitted into the Union as a State at the midpoint of the fiscal year, the several resource agencies of the Department of the Interior will continue their important functions, although in some cases statehood results in changed emphasis.

For example, the Alaska Railroad, operated by the Office of Territories, will play an important role in the further development of the new State. In order better to serve the Alaska population, its businesses and industries, the Railroad is continuing its program to improve equipment and facilities.

Transportation in Alaska, as elsewhere in our territorial possessions, is a key factor in improving the living standards and economic opportunities for the increasing population of these areas.

Fish and Wildlife Resources

Together with the enormous upsurge in population, quick transportation, repeating guns, better ammunition, electrical aids in fishing, and many other instruments and implements have immeasurably increased recreational use of our Nation's precious wildlife resources. Wildlife habitat has dwindled to a fraction of what it was some decades ago, and there is an increasing demand upon the supply of fish in our oceans.

Under these conditions, it is readily apparent that the task of the Department's Fish and Wildlife Service in seeking to assure adequate wildlife resources to meet growing future needs is a most difficult one.

Three Primary Goals

Consequently, in its wildlife programs, the Department has set three primary goals: Maximum production, intelligent harvest, and highest utilization.

In spotting and studying new fishing grounds, the Department constantly enlarges known commercial fishing areas, thereby increasing the mean food supply for American tables.



Achievement of these goals will mean:

First, that with greatly reduced wildlife habitat the Nation will have a wildlife supply rivaling that which it had in the days of the primeval forest;

Secondly, that the resources will be harvested in such a way that there will always be enough left to continue the species; and,

Finally, that there will be no costly waste of wildlife resources through nonuse or misuse.

Cooperative Effort

Other agencies and other forces are working energetically with the Federal Government in this cooperative aim.

Day by day, an enlightened public is becoming more conservation conscious. An ever-increasing fund of pertinent scientific information is being developed, of which the Department contributes its proportion. A number of other Federal agencies are presently considerably more concerned with wildlife conservation and development than formerly. State conservation agencies and numerous private conservation groups put perpetuation of fish and wildlife at the top of their activities, and other public and private organizations list such activities prominently in their programs.

The drive to safeguard and develop wildlife resources goes unceasingly on land and sea. In this effort the Department's Fish and Wildlife Service performs important duties in its own special field of responsibility, while at the same time sharing cooperative responsibility with the 50 States and a score of Nations.

Numerous Channels of Activities

The avenues along which the Service works to meet recreation needs include oceanographic studies, biological and technological research, river basin and water project planning, improved management practices, research on chemical controls, Federal aid to States, and cooperative activities.

Implements involved in the program include nearly 18 million acres of National Wildlife Refuges; a hundred fish hatcheries; nearly two score laboratories devoted to various phases of fish and wildlife research; a fleet of research, exploratory and law enforcement vessels; half a hundred planes, a wide range of equipment and a staff of professional and technically trained employees.



Game biologists of the Department of the Interior often do unique chores in their efforts to insure our game population is sufficient to meet the hunting pressures created by expanding population.

Probing Secrets of the Sea

In recent years the probing of the secrets of the sea has been accelerated, and the Department of the Interior has been among the active agencies in this field. As the work progresses, the Department expects to help unravel some of the mysteries, such as those surrounding the life and death of many species of food fish and in the end to make the production of food in the ocean as scientific as the growing of grain and livestock on farms. But before that goal can be achieved, there must be more knowledge of the life history and migration of the various species of fish; more knowledge of the food chain, how it starts and how it develops; and more knowledge about the composition of ocean water, about its thousands of currents, the effect of temperature and light on waves and weather and countless other things of which presently little or no knowledge exists.

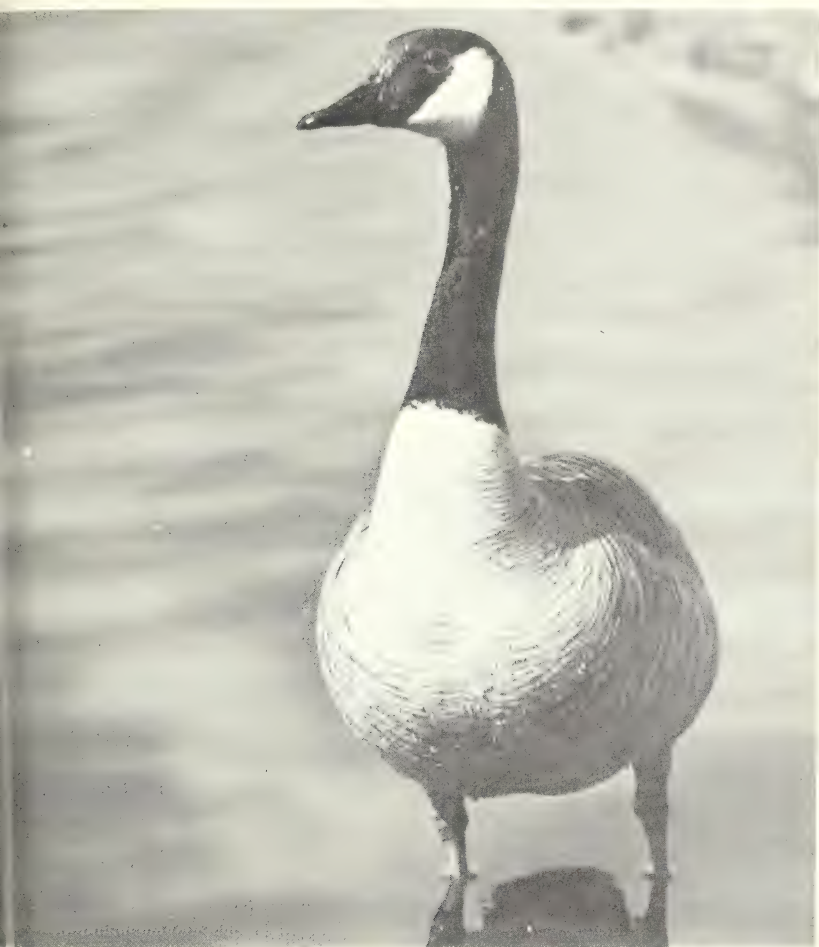
One major breakthrough in marine biology is believed near at hand in the development of methods by which American salmon can be identified as distinct from Asian salmon, and the charting of the migrations of these races to show when and where and to what extent they intermingle. This huge task is being undertaken by scientists of three Nations, and when complete, will be the basis upon which management plans of two continents for securing the maximum sustainable yield of salmon can be built.

Growing Practice of Chemical Control

In the rapidly growing field of chemical control, the Department's Fish and Wildlife Service has begun a broad scale investigation of the effects of the 200 obtainable pesticides, insecticides and herbicides upon America's fish and wildlife resources. The purpose of this study is to meet agricultural pesticide needs without seriously depleting the fish and wildlife which might be subjected to their uses.

A field of chemical control which has been pushed vigorously by the Service is that of selective control. Pains-taking research which 5,000 chemical formulations were tested by the Service has resulted in poisons which would kill the dreaded and destructive lamprey larvae without damage to desirable varieties of fish. This success has led to a wide search for selective toxicants for the control of other predators.

Another chemical success has been achieved in developing repellents which protect seeds and seedlings without harm to wildlife, thus helping to overcome a serious agriculture and reforestation



through wildlife research and management, the Department of the Interior preserves and improves wildlife habitat and breeding grounds so that hunting and fishing facilities are available for America's increasing millions.

problem, while at the same time protecting wildlife resources. In the area, the reforestation cycle has been cut from 10 to 20 percent because of the protection given to seeds and shoots and young stock.

Conservation in Water Development Projects

Through the persistent efforts of conservation agencies, both public and private, the protection and development of fish and wildlife

resources has taken an important place, guaranteed by legislation, in the planning of water development projects and in the development of river basin areas. The importance of protecting and enhancing fish and wildlife resources in agricultural and industrial developments is, as a result, becoming a fixed American practice.

At the same time, the Department's Fish and Wildlife Service is moving toward more effective management of its own resources. Research, bird banding, and improved survey techniques are resulting in more reliable waterfowl inventories. Better management

Preservation of America's important salmon fishery resources cannot be left to nature, and salmon on the tables of American homes often get their start in life in Departmental fish hatcheries.



refuge areas is making it possible for many refuges to carry from 2 to 10 times as many birds as formerly. Elimination of noxious weed growth in some places has had the effect of adding hundreds of acres to the refuge system. Research on commercial fishing grounds is leading to mesh-size limitations which prevent the catching and loss of fish too small to market.

To protect the duck population in the face of shrinking water supplies, the Department's programs are often geared to make water do double duty. This is accomplished in a variety of ways—by adding a few feet to a dam to flood an area in spring highwater and thus have a duckfood producing area after the summer draw-down; by utilizing water without consuming it as is done when water is run through a marsh to freshen it and then returned to the stream; by reclaiming water which is polluted by urban or factory wastes; or by managing certain areas in such a way that ducks can value out of waters which would otherwise stagnate or evaporate.

Federal Aid to States

Under the Federal Aid program, funds are channelled through the Department to the several States, which in turn conduct research and management programs on their own fish and wildlife resources. The program in actuality has a double effect—it not only assists the States in producing more fish and game, but at the same time helps in the establishment of professional fish and wildlife staffs in every section of the country.

The Department's aim in its many related programs in the fish and wildlife field is to preserve and expand our wildlife heritage so that Americans of the future, as well as today's citizens, will know and appreciate the wildlife world of John Audubon and Daniel Boone—the world known and beloved by all our forefathers.

Recreational Resources

Probably in no other area of National life are the immediate demands being placed on an invaluable resource by the explosive nature of population growth more dramatically illustrated than in the increasing pressures on America's recreational resources.

The growth of population over the past few years provides some startling statistics. Population growth, however, does not begin to approach the corresponding rate of increase in outdoor recreational activities by countless millions of Americans.

In our national parks, for example, there were just 1 million visitors in 1920. By 1958, this figure increased to 60 million—an

increase of 6,000 percent, far outstripping population growth itself. By 1966 park visitation is expected to exceed 80 million.

The Department of the Interior through its many agencies—the National Park Service, the Bureau of Reclamation, the Fish and Wildlife Service, the Bureau of Land Management, and the Bureau of Indian Affairs—is taking urgent action to meet the recreation needs of our citizens today and to provide recreational facilities for Americans of the future.

Each agency is working earnestly to meet the mounting pressure on our recreational resources which population growth and increasing leisure time will inevitably bring.

Positive Needs

A number of factors in our national life have contributed to the astonishing trends for expanded use of Federal, State, local and private recreational resources.

First, of course, is the dynamic rate of population growth itself. Along with this, unparalleled prosperity since the end of World War II has resulted in increased disposable family income and greater leisure time for our people. These factors, coupled with accelerated improvement in our network of roads and highways, have made Americans a traveling, sightseeing people intent on knowing and enjoying the scenic, historic, and outdoor resources of the Nation.

These facts have led recreational planners at all levels of Government to take new, forceful steps to preserve and improve existing recreational resources and to develop additional resources to cope with the constantly increasing population pressures on recreational facilities.

Positive Programs

The agencies of the Department of the Interior—either as a prime function or a corollary activity—have been in the vanguard of those seeking to provide wholesome recreational facilities for all Americans.

The National Park Service with its 10-year program, Mission 66, is making progress in preserving, protecting, and improving the national park system.

The Bureau of Reclamation, whose prime responsibility is the development of irrigation for the water-hungry West, is creating manmade lakes, thereby establishing new water recreational facilities in the arid areas of our Nation.



The national parks of the Department of the Interior provide scenic majesty and wholesome outdoor recreation for millions of Americans annually.

The Fish and Wildlife Service, through its Bureau of Sport Fisheries and Wildlife, carries out far-reaching programs designed to provide abundant supplies of fish and wildlife for recreational fishing without permanently depleting our wildlife resources. In less spectacular, but equally important ways, the Bureau of Land Management and the Bureau of Indian Affairs are making creative contributions to improving and increasing the recreational facilities of America for present and future generations.

Challenge

Unfortunately, however, at the time of greatest need for recreational resources, some of the prime areas for recreational use are disappearing from the face of the earth. Population means people—and people need land for housing, for shopping centers, and for industry to meet the demands of a constantly higher standard of living. Everywhere across the nation, the swelling tide of people and the 20th century phenomenon known as “urban sprawl” is swallowing up America’s open spaces from coast to coast.

For example, the critical scarcity of land for public recreation use is illustrated by the loss of unspoiled shoreline areas. Twenty-five years ago, the Department's National Park Service surveyed our seashore resources, listing 12 areas as most deserving of dedication for public recreational use.

One of these areas, Cape Hatteras National Seashore Recreation Area, has been established but 10 of the remaining 11 are in various stages of private or commercial development.

In 1954, another survey showed that almost every worthwhile shoreline area accessible by road—on the East, West, and Gulf coasts, as well as the southern portion of the Great Lakes—is being rapidly filled by private resorts, estates, suburbs, and commercial developments.

A Partial Answer

For the country as a whole, there is only 1 mile of shoreline for public recreation for every 220,000 people.

In the past year, the Department requested Congress to approve legislation which would permit preservation of some of the remaining shoreline area of the United States. Legislation now introduced would authorize appropriation of \$15 million to acquire three additional national shoreline areas.

There are also hundreds of smaller areas which provide excellent opportunities for public use and enjoyment and are most suitable for administration by the States—areas which are also being withdrawn from public use through other pressures.

The National Park System

Working to provide additional public shoreline areas is only one phase of a concerted Department effort to meet the recreational needs of our growing population.

Mission 66, a long-range program of the Department instituted in 1956 and administered by the National Park Service, will provide for the conservation, protection, improvement, and expansion of our national park system to meet inevitable population pressures on park resources.

The National Park Service—which administers 181 areas of scenic, scientific, or historical importance—has made rapid strides in restoration and development of park areas.

When Mission 66 was inaugurated, our parks were neither staffed nor equipped to protect their irreplaceable features, nor to provide proper facilities for the increasing millions of visitors. Lodging

and eating facilities were inadequate and outmoded. Interpretive services for proper park enjoyment were lacking while priceless park features were deteriorating.

Mission 66—which will be completed in 1966, the fiftieth anniversary of the Department's National Park Service—will insure that our national parks, monuments, and shrines will be adequately protected for the benefit of present and future generations.

Mission 66 Progress

In the first 3 years of operation of Mission 66, the National Park Service has increased park staffs to provide proper protection of natural park features and to facilitate service to the mounting tide of visitors.

Through the investment of over \$100 million, the National Park Service has provided new and better park roads, trails, parkways, visitor centers, museums, campsites, utility systems, and a variety of interpretive services throughout the Nation. The sign, "A Mission 66 Project," has become a familiar landmark to millions of traveling Americans.

During the same period, private enterprise has invested more than \$17 million to provide new hotels, lodges, motels, restaurants, and other accommodations which allow park visitors to do more than merely drive through park areas.

While this phase of Mission 66—and its continuing additions to its facilities and capabilities—is meeting the more pressing needs, the National Park Service recognizes that new ways must be found to expand recreational resources and to save additional unspoiled areas for park additions.

Mission 66 Planning

Accordingly, the National Park Service is reappraising the Nation's outstanding scenic, scientific, historic, and cultural resources. Work is in progress to inventory and to evaluate the factors that affect public demand for these facilities—population shifts, transportation patterns, trends in recreational habits and interests, and present and potential uses of our recreational resources.

Results of this intensive planning and survey effort will not only permit efficient park planning over the years ahead but also will provide basic data for the National Outdoor Recreation Resources Review Commission in its study of future requirements for total outdoor recreational opportunities and its formulation of long-range policies and programs to meet these needs.

The Commission—composed of four Senators, four Representatives and seven citizen members—will inventory and evaluate total national recreation resources and the needs of the Nation for the years 1976 and 2000. Its work will go far in coordinating and improving recreational resource efforts at all levels.

As part of the survey work in progress, studies are being made of the basic adequacy of the National Park System itself and the individual areas which comprise it.

Historic and Cultural Resources

The National Park Service has also reinstituted its National Survey of Historic Sites and Buildings which was discontinued during World War II. By producing an authoritative document identifying, describing, and evaluating archeological and historic sites and buildings of national significance, the survey will accomplish the significant objectives.

It will aid the Federal government in determining its proper role in historic and archeological preservation and will provide a basis for development and interpretation of these resources.

It will provide information for guidance in the use and disposal of surplus Federal property containing historic and archeological values not currently protected.

It will develop basic data for State, local, and private historical bodies in their activities to conserve significant sites of the Nation's history and prehistory.

The survey is a step forward to insure that our children's children will know, understand, and gather inspiration from the places which shaped our Nation's history and progress.

Recreation on Wildlife Lands

In 1958, the latest year of record, the national wildlife refuge system administered by the Department's Fish and Wildlife Service recorded more than 9 million visitors—in contrast with nearly 3 million in 1951.

While the recreational use of wildlife lands is limited to the areas where such activities will not interfere with wildlife protection and propagation, this increase in visitation of 170 percent is



Increasing millions of Americans are visiting the national parks annually. Under the National Park Service Act of 1906, the Department of the Interior's long-range park development and protection program, is designed to meet the demands of our population on the parks.



Under the National Park Service Act of 1906, the Department of the Interior's program to expand park facilities to meet population growth, preserves and protects our scenic, historic, and wilderness resources. Here, visitors register for tour of Abraham Lincoln National Historic Park.

Recognizing the popularity of water recreation and public demand for the use of reservoirs for recreation, the Congress authorized recreation as one of the specific beneficial uses of the gigantic Upper Colorado River Storage project.

The scenic and scientific values of this area have been recognized for decades. The National Park Service, for example, reported on the entire river basin in 1941 as follows:

"The Colorado River is one of the outstanding recreational regions in the United States because of its great variety of natural scenery, climatic conditions, areas and objects of scientific interest, and abundant evidence of prehistoric occupation. . . . Here one may enjoy a large amount of sunshine and find perfect climatic settings for various types of outdoor recreation."

The Upper Colorado River project, enormous in scope and imagination, will contribute not only large amounts of water for irrigation and hydroelectric generation, but also will create a great network of manmade lakes which will provide many hours of water recreation for some recreation for our growing population in years to come.

Increased Use of Reservoirs

Current use of Reclamation reservoirs is mounting phenomenally. In 1955, 10 million people visited and enjoyed the water recreation facilities.

Man-made lakes in the arid west, such as Lake Mead behind the gigantic Hoover Dam, bring water sports and recreational facilities to meet the family needs of our growing population.



ilities of Reclamation reservoirs. By 1959, 19.5 million persons used these recreational resources—an increase of almost 100 percent in less than 5 years.

Coordinated planning for recreational facilities is now and will continue to be a part of each Reclamation project. Current facilities are being improved for recreational use. As the Bureau of Reclamation creates new recreational resources, administration of these areas is transferred to the Fish and Wildlife Service, the National Park Service, the Forest Service, and to State and local agencies.

Through the efforts of the Bureau of Reclamation, the highways and roads of the West carry automobiles, packed with camping equipment, followed by boat trailers to water paradises where only mud, sagebrush, and intermittently flowing streams once existed.

The Important Perspective

The American who knows his country—its scenic places and wilderness, its historic and cultural sites, its outdoors as a positive part of life—lives intimately with the timeless concepts of freedom. All Americans, as private citizens or in collective groups either public or private, have a never-ending responsibility to themselves and their posterity to conserve and enjoy these priceless resources. The technical responsibility for the conservation of the recreational and physical resources described on the preceding pages falls on the Department of the Interior—an expression of the will of the people of the United States through their elected representatives. Despite the rapid tempo of modern life and the myriad of its material comforts and benefits, the people of America are close to their history, close to their land, and close to one another. This is our heritage and the source of our material and spiritual strength.

The Department assumes a solemn trust in its resource work and approaches its responsibilities with the precept that Government is not an end in itself but a working tool to serve the best interests of all Americans today and in the years to come.



PART II

ANNUAL REPORTS OF THE
BUREAUS AND OFFICES OF THE
DEPARTMENT OF THE INTERIOR



Office of the Assistant Secretary *Water and Power Development*

Frederic G. Aandahl, *Assistant Secretary*



THE ASSISTANT SECRETARY for Water and Power Development discharges the duties of the Secretary of the Interior with respect to the Department's programs in the field of water and power development.

The Assistant Secretary exercises secretarial direction and supervision over the Bureau of Reclamation, Bonneville Power Administration, Southeastern Power Administration, and Southwestern Power Administration. The principal function of the latter three agencies is to market surplus power generated in their respective areas at Federal projects. The Bureau of Reclamation constructs water-use projects whose primary purpose is the reclamation of arid and semi-arid lands in the West, and also markets surplus power produced at Federal projects in the West outside the boundaries of the Bonneville Power Administration and Southwestern Power Administration and at Falcon Dam on the Rio Grande River, an international project.

The activities of the Office of Saline Water, which are more fully described in another section of this report, and the defense functions of the Secretary with respect to electric power are also the responsibility of the Assistant Secretary for Water and Power Development.

The table on the next page, prepared on a consolidated basis for the fiscal year 1959, shows the capacity installed in hydroelectric power plants from which surplus power is marketed by Department of the Interior agencies, net energy generation, energy marketed, and gross revenues.

Power production and marketing data, fiscal year ended June 30, 1959

| Marketing agency | Installed capacity, as of June 30, 1959 (kilowatts) | Net energy generated (million kilowatt-hours) | Energy marketed (million kilowatt-hours) | Gross revenue (thousands of dollars) |
|--|---|---|--|--------------------------------------|
| Bureau of Reclamation..... | ¹ 5,902,050 | 27,456 | ⁴ 15,180 | ⁵ 55 |
| Bonneville Power Administration..... | ² 3,469,000 | 18,824 | 30,264 | 61 |
| Southeastern Power Administration..... | ² 1,259,600 | 2,691 | ⁶ 2,713 | 1 |
| Southwestern Power Administration..... | ² 601,000 | 1,319 | ⁶ 1,924 | 1 |
| Total..... | 11,231,650 | 50,290 | 50,081 | 15 |

¹ Includes 745,000 kilowatts in Corps of Engineers, 31,500 kilowatts in International Boundary and Water Commission, and 5,125,550 kilowatts in Bureau of Reclamation projects.

² Capacity in Corps of Engineers projects.

³ Bonneville Power Administration also markets power from Bureau of Reclamation's Grand Coulee, Hungry Horse, Chandler and Roza power plants with a capacity of 2,282,250 kilowatts. (This amount included in Bureau of Reclamation installed capacity.)

⁴ Excludes 11,324 million kilowatt-hours delivered at Grand Coulee, Hungry Horse, Chandler and other power plants by Bureau of Reclamation to Bonneville Power Administration. (This amount included in Bonneville Power Administration energy marketed.)

⁵ Excludes \$16,755,000 revenue received by Bureau of Reclamation from Bonneville Power Administration. (This amount included in Bonneville Power Administration gross revenue.)

⁶ Includes purchased energy.

The Assistant Secretary for Water and Power Development participated in the negotiation of contracts and agreements for the disposition of water and power from Federally constructed water projects. Several new and revised contracts for integration, marketing and sale of power were approved. Details of these activities are explained in other sections of this report.

In the Southeast an analysis of the rates and charges for power of power from the Wolf Creek, Dale Hollow, and Center Hill projects on the Cumberland River to Tennessee Valley Authority was sent to the Chairman of the Senate and House of Representatives Public Works and Appropriations Committees. In 1948 the Government made a long-term contract with the TVA to sell power at rates based on then existing policies and practices. In 1955 the Department requested the Federal Power Commission to approve the rates and charges in the 1948 contract as amended. On May 20, 1958, the FPC issued an order disapproving the request. Surplus power produced at these projects is marketed under section 5 of the Flood Control Act of 1944.

During the fiscal year, the Department through the Assistant Secretary for Water and Power Development reviewed 64 reports of the Corps of Engineers, Department of the Army, primarily for flood control and navigation improvements; 27 Federal Power Commission applications for permits and licenses for hydroelectric developments; and one report of the Department of State on the Diablo Dam, International Boundary, Texas and Mexico.

The Assistant Secretary served as Departmental representative on the Inter-Agency Committee on Water Resources and on the President's Advisory Committee on Public Works Planning, State Department Advisory Committee on Canadian-United States Columbia

er Development, and participated in inter-agency conferences on coordination of watershed, flood-control, and reclamation programs.

He conducted conferences in the field and in Washington on river marketing and irrigation development, attended by water and power users, Congressional delegations, and representatives of public interests and industry. Outstanding among these, were those in connection with the Missouri River Basin 1959 additional power allocations. He directed the organization of and conferred with a group of Federal and non-Federal advisors to the Secretary on the selection of processes and sites to meet the time table specified in Public Law 85-883 for saline and brackish water conversion programs.

Staff of the Office served as Departmental representatives on inter-agency committees concerned with radio frequency allocation, procurement of heavy electrical equipment, international water developments, the International St. Croix River Engineering Board, public works planning, financial practices for water and power projects, economic analyses, atomic energy, and allied technical subjects.

Bureau of Reclamation

Floyd E. Dominy, *Commissioner*



WATER IS THE MOST IMPORTANT single natural resource required to permit expansion of population and the economy in the State semiarid western region in which the Department of the Interior's Bureau of Reclamation operates. During the fiscal year ending June 30, 1959, the Bureau of Reclamation made sound and significant progress in development of this basic resource.

During 1959, construction was completed on 3 water storage dams, with a combined storage capacity of 551,000 acre-feet; 3 diversion dams, and 410 miles of canals, pipelines, laterals and drains. Irrigation facilities were completed to serve 199,471 acres of land. Installed hydroelectric generating capacity of 45,450 kilowatts was completed. This construction activity represented an addition of about \$180 million to the Federal Government's \$3 billion investment in western projects.

Notable construction starts during the year included Paonia Dam on Colorado's Paonia project, and Stanaker Dam on the Central Arizona project, first "participating" irrigation projects of the billion-dollar, five-State Colorado River Storage project. Final design was completed on initial features of the Farwell unit of the Missouri River Basin project, Nebraska, and the San Angelo project, Tex.

The Bureau of Reclamation's 79 irrigation projects serve more than 100,000 farms and embrace a total of 8,049,642 acres. A total of 5,737 acres was irrigated during 1958, producing crops valued at \$744,504. This record-breaking harvest brought the cumulative value of crops produced in Reclamation project areas since 1906 to \$14.2 billion, nearly five times the net Federal investment in Reclamation.

Bureau projects provided 260 billion gallons of water for municipal and industrial and other nonirrigation uses in 1958. This water was delivered to 106 municipalities and 68 industrial entities in 32 project areas scattered throughout the West.

The importance of this aspect of the Reclamation program is indicated by the fact that about 8½ million persons live in the municipal and industrial entities served by the Bureau, including the large metropolitan areas of Los Angeles and San Diego. These are in addition to the 790,000 who live on irrigated homesites on the fringe of the cities and towns on Reclamation projects. Nearly a half a million persons make up the farm families who reside on project farms. Thus the daily activities of nearly 10 million persons are vitally affected by Reclamation water supplies.

In addition to these direct uses of water resources developed and distributed by going Reclamation projects, a tremendous recreational resource has been created by the artificial lakes built in the semi-arid West for water conservation purposes. The Bureau's reservoirs provide 1⅓ million acres of water surface for recreational purposes. Public visitations to these reservoirs tripled in the past 8 years and reach a total of nearly 19.5 million visitor days of use in 1958.

The new popularity of boating in the West was typified by report 7 of the Missouri River Basin, where, on 28 Bureau reservoirs, watercraft in use during the year totaled 55,700, with a peak-day use at Horsetooth Reservoir in Colorado of 1,150 boats.

In spite of an increase in activities, the continued utilization of carefully planned staffing control resulted in a further decline in Bureau employment during fiscal year 1959. At the beginning of the year there were 10,125 full-time employees on the rolls; at the end of the year, the figure was 9,717. Eleven project offices were established and three offices at completed projects were closed.

During the year, the Bureau, in cooperation with other agencies, was engaged in comprehensive surveys in 10 river basins throughout the West, in 12 subbasins of the Missouri River Basin, and in Alaska. A total of 134 projects were under investigation at the close of the year.

A far-reaching new loan program for local construction of small Reclamation projects and distribution systems began to hit its stride in fiscal 1959. Congress appropriated \$14,497,000 for the first time. Loans approved under the Small Reclamation Projects Act of 1956 and construction was initiated on four projects. Eight other applications for loans totaling \$16,032,000 had been approved by the Bureau or forwarded to Congress. Three distribution system loans also were approved.

As of June 30, the Bureau operated 41 powerplants with a total installed nameplate capacity of 5,137,550 kilowatts. In addition, the agency marketed power generated at four U.S. Army Corps of Engineers powerplants, with a capacity of 745,000 kilowatts and one 31,500-kilowatt powerplant installed by the International Brotherhood

ary and Water Commission. Total sales by the Bureau aggregated 5,504,260,413 kilowatt hours, with \$70,968,412 in gross revenues.

Design improvement and research at the Bureau's Engineering Laboratories in Denver, Colo., and in the field, led to substantial achievements that will increase project efficiency, reduce water evaporation and waste, and otherwise save money and water for water users. Results of large-scale reservoir evaporation tests at Lake Hefner—part of the municipal water supply system at Oklahoma City, Okla.—were published.

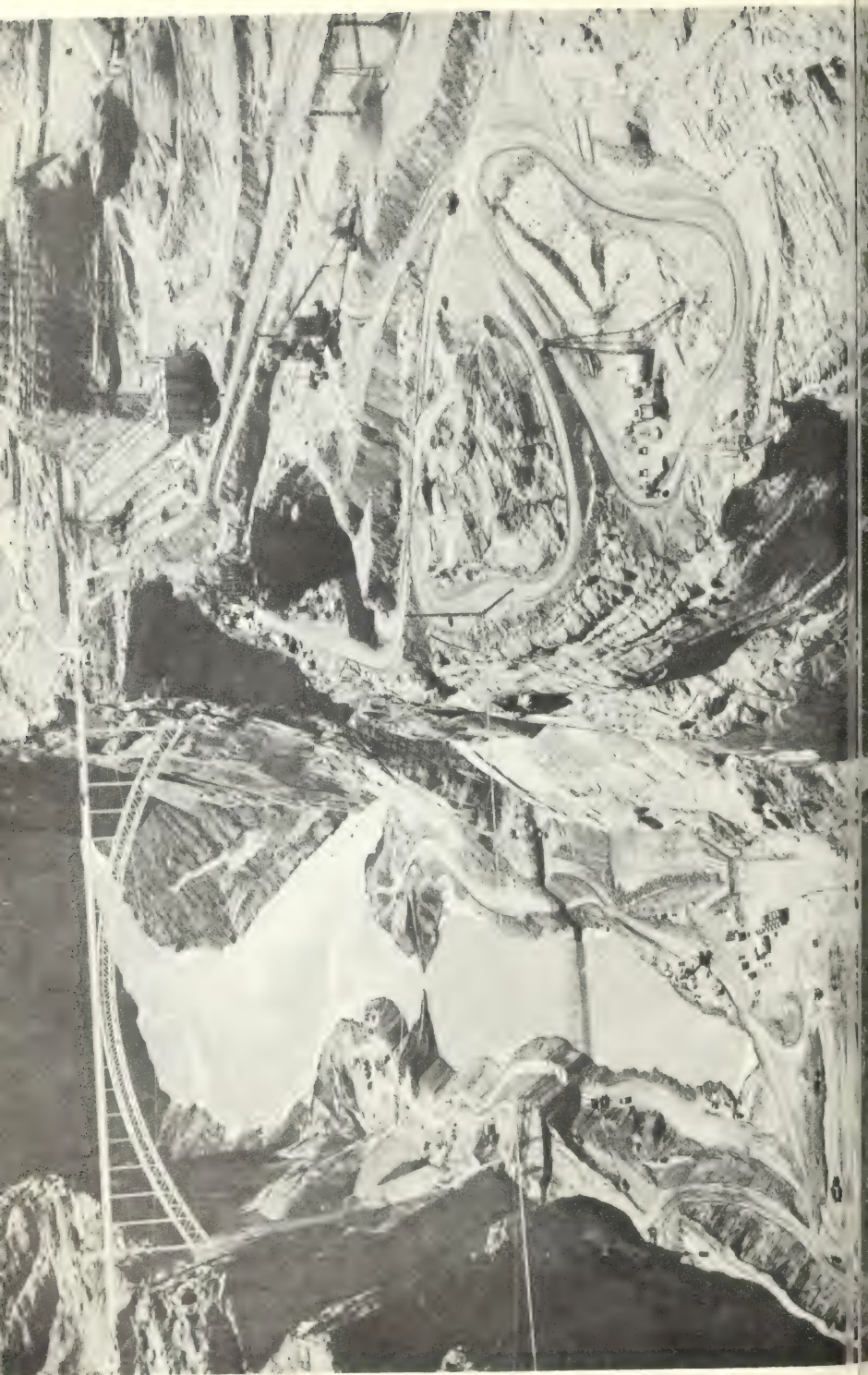
These latter studies showed that even under the unfavorable conditions which prevailed at Lake Hefner during the 1958 tests, a 9 percent reduction of evaporation loss was achieved through use of a monomolecular layer of hexadecanol (an invisible chemical layer one molecule thick) on the reservoir surface. Under ideal conditions, evaporation savings at the prevailing temperatures could have been increased fourfold.

Reclamation "know-how" was exported to assist friendly semiarid countries through the Bureau's Foreign Activities program. On-the-job training was provided to 86 technicians from 33 countries, and additional individuals spent shorter periods in the Bureau's various offices. Twenty-three Bureau representatives visited 12 countries as consultants, 6 engineers were on extended advisory assignments in Taiwan and Australia, and a team of 9 initiated a reconnaissance survey of the Blue Nile River Basin in Ethiopia.

A total of 47 repayment contracts were executed with irrigation conservancy districts for repayment of costs of Reclamation project works. This brought the total value of all Reclamation repayment contracts to \$916,073,149, of which \$140,294,832 has been repaid. Delinquencies are negligible. In addition, more than \$125 million will be returned to the Government in water service payments under contracts now in force.

A modification of the Reclamation Project Act of 1939 was enacted into law during the year. This legislation authorizes the adoption and operation of a variable repayment formula to permit variations in annual payments consistent with economic conditions, without extending the contracted repayment period.

Soil and moisture conservation work was carried out in 108 individual programs on 49 Federal irrigation projects or units. Much progress has been made in reducing costs and water losses due to weeds on irrigation systems through the Bureau's weed control program and it was estimated that such losses have been reduced \$12 million annually as compared to 1948. A total of 339 cooperative agreements with other Federal, state, and local agencies for studies on the efficient use of soil and water, recreational management, and



ther problems related to the management and operation of Reclamation projects were underway at the close of the fiscal year. Roughly half of the 10 million acres of land under the Bureau's jurisdiction has been turned over to other Federal, State and local agencies for recreational administration. Eleven development farms are operated for research and demonstration purposes.

The Bureau conducted one land opening on the Columbia Basin project, making available for settlement 31 farm units embracing 223 irrigable acres of new land. Since the close of World War II, land openings have been held on 14 projects, opening a total of 756 new farm units, encompassing 263,856 irrigable acres.

Formal dedication services were held to mark completion of construction of the Glendo Dam and its 24,000-kilowatt powerplant on the Missouri River Basin project in Wyoming, and of the Bureau-designed Glen Canyon highway bridge, highest steel arch (700 feet) and second longest (1,271 feet) of its type in the United States.

Dam embankment placement at a rate of more than 1 million cubic yards per month pushed construction of the country's highest earth-fill dam, the 537-foot high Trinity Dam on California's Central Valley project. Trinity Dam is about 60 percent complete. The Ventura project in California, and the Roza and Kennewick Divisions of the Yakima project in Washington were substantially completed.

This was the first year of full-scale operation for the Palisades project on the Upper Snake River, in Idaho. The usable storage capacity of 1,200,000 acre-feet was filled for the first time, 558.8 million kilowatt-hours of hydropower was generated, and the Palisades Reservoir became a favorite fishing and recreation spot.

All of the larger Bureau reservoirs are operated to achieve the maximum degree of flood control consistent with reasonably safe operation for their primary purposes. In the Northwest, for example, preliminary data indicated that storage control by Bureau reservoirs reduced peak flows on the lower Columbia River by 70,000 to 100,000 cubic-feet per second.

The impact of a regulated river on an area was well typified by the lower Colorado River. Colorado River water released during

Construction activity at site of Nation's second highest dam—Construction activities dominate this section of the Glen Canyon gorge of the Colorado River where the Bureau of Reclamation's 700-foot Glen Canyon Dam is being built to rival the 726-foot Hoover Dam farther downstream. The contractor's cofferdam construction is visible at lower left while excavation for the spillway and erection of the concrete-piling plant are progressing on the right rim.

the year from Lake Mead supplied domestic and industrial water to some 6 million people in the Pacific Southwest, irrigated more than a million acres of land in this country and Mexico, to produce crops valued at \$239.7 million on the U.S. acreage alone, and generated nearly 6 billion kilowatt-hours of energy—roughly 15 percent of the electrical energy consumed in the Pacific Southwest. And this was accomplished in spite of the fact that inflow to Lake Mead above Hoover Dam during the year was only about 54 percent of the 36-year (1923–58) average.

Three major contracts, totaling approximately \$3½ million were awarded for manufacturing of the last major generating unit in the Hoover powerplant. Scheduled for operation in 1961, the 95,000-kilowatt unit will complete the Hoover powerplant, raising it to its full capacity of 1,344,800 kilowatts.

Preliminary studies of the transmission system required for the Colorado River Storage project indicated the possibility of using extra-high-voltage transmission. A tentative report on a 345-kilovolt backbone transmission system, showing the results of these preliminary studies, was prepared for initiating discussion with potential customers. The heaviest line in Bureau transmission systems is 500 kilovolts.

When the flow of the mighty Colorado River was first diverted in the 1930's to construct Hoover Dam, the closure of the diversion dam made headlines throughout the world. The river was diverted again by the Bureau on February 13, 1959, when closure of the upstream cofferdam was effected at the Glen Canyon area and the full flow of the river was diverted through the right diversion tunnel. The special attention this incident received in the press indicates that diversions of mighty rivers have become commonplace.

Construction of the 4,500-kilowatt Big Thompson Powerplant and switchyard in Colorado, initiated in fiscal 1957, was completed in June 1959. This marked completion of the Colorado-Big Thompson project, started in 1938.

Design and Construction

The scope of the year's achievement in construction is indicated by the completion of irrigation facilities to serve 199,471 acres of land and installation of 45,450 kilowatts of hydroelectric generating capacity. Construction was completed on 3 storage dams which have a combined capacity of 551,000 acre-feet, 3 diversion dams, and 10 miles of canals, pipelines, laterals, and drains.

Awarded during the fiscal year period were 465 construction, material, equipment, and supply contracts. The total value of these con-

acts was about \$72 million. Contracts for construction totaled about \$62 million, or about 86 percent. The 145 construction contracts in progress at the end of the fiscal year had a total face value about \$345 million.

On the Columbia Basin project in Washington, irrigation facilities were completed to serve an additional 34,000 acres, bringing the total to 385,000 acres. Completed was the 15-foot-diameter, 3-mile-long Wahluke Siphon. Also completed were 62 miles of laterals, including 8 pumping plants, on the Wahluke Branch Canal and the 11-mile Esquatzel Diversion Canal. In the same State, the 11,250-kilowatt capacity Roza Powerplant on the Yakima project began commercial operation.

Construction progress in Oregon was highlighted by completion of the earth and rock-fill Howard Prairie Dam on the Rogue River basin project and the Soda Creek Diversion Dam. Completed also were 15 miles of delivery canal and collection canals. Virtually completed at the end of the fiscal year were the 16,000-kilowatt Green Springs Powerplant and Power Conduit. The earthfill Keene Creek Dam was nearing completion. Work was begun on enlargement of Emigrant Dam, a thin concrete arch structure built about 35 years ago.

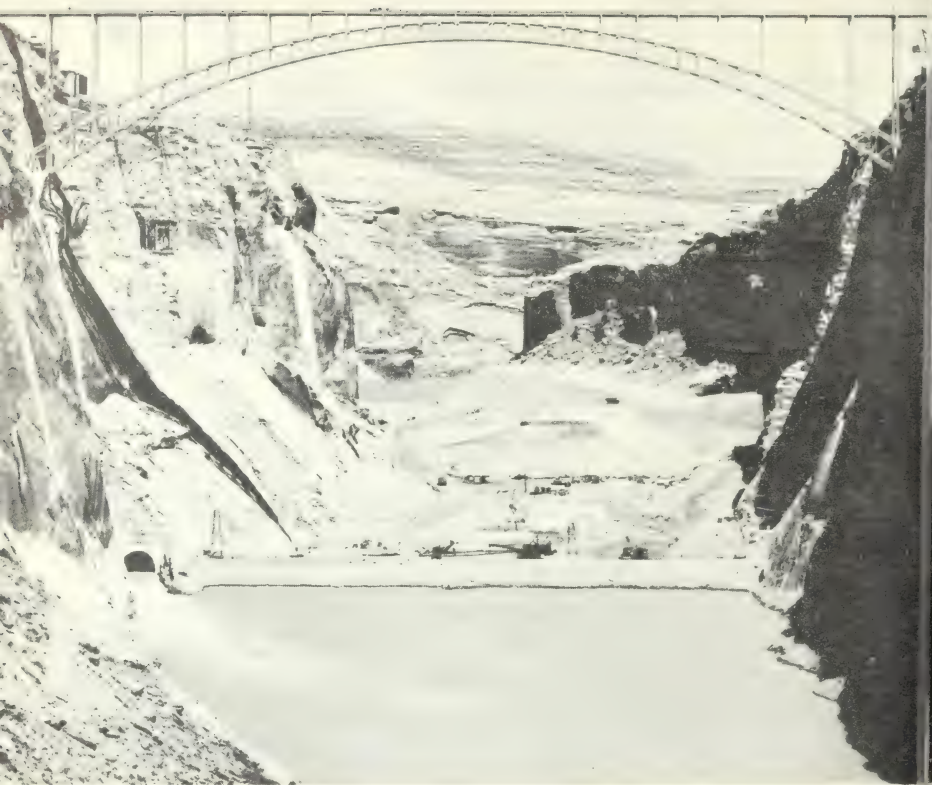
Elsewhere in Oregon, construction began on the earthfill Prineville Dam on the Crooked River project, now about 35 percent completed. Construction of Wasco Dam, an earthfill structure on the Wapinitia project reached the midway point.

Progress on Trinity Dam

By the end of the year, some 12 million cubic yards of the 33-million-cubic-yard embankment required for 537-foot high Trinity Dam in California had been placed. Excavation and concrete lining of the 10.8-mile-long, 17.5-foot-diameter Clear Creek Tunnel, second largest tunnel on a Bureau of Reclamation project, was about 55 percent completed. The dam and tunnel will ultimately make possible the project's average annual transbasin diversion of 865,000 acre feet of surplus waters from the Trinity River watershed to the Central Valley Basin.

Also in California, Twitchell Dam, an earthfill structure on the Santa Maria Project, was completed, as was the earthfill Casitas Dam on the Ventura River project. Also completed on the latter project were the Robles Diversion Dam, Robles-Casitas Diversion Canal, and miles of distribution system pipelines.

Construction progress on the 700-foot high Glen Canyon Dam, principal feature of the Colorado River Storage project, in northern Arizona, was marked by completion of the two 41-foot, 1½-mile long



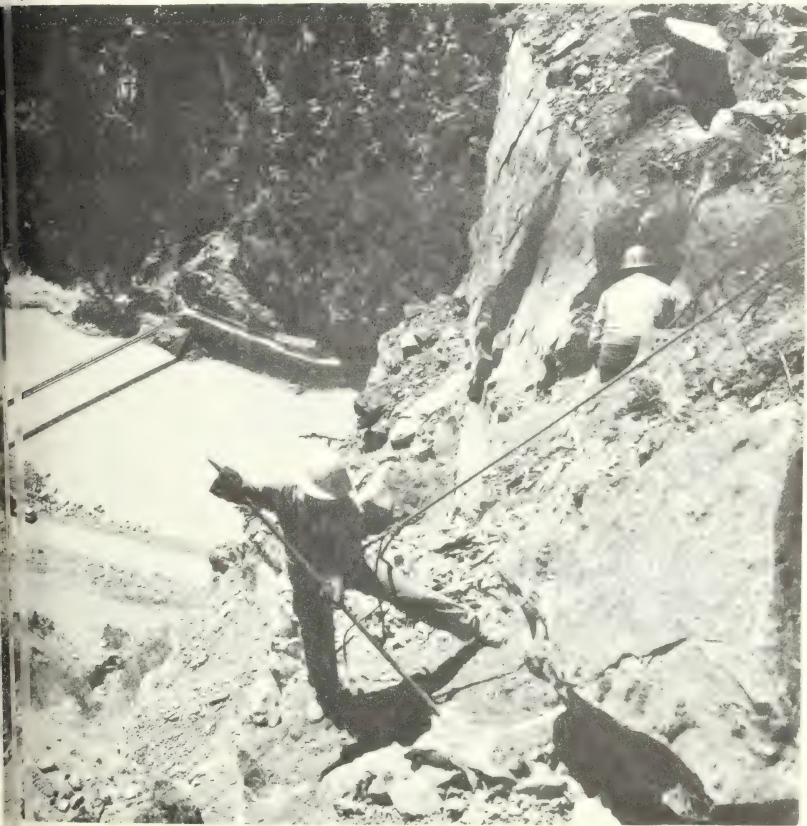
World's highest steel-arch bridge frames dam construction scene— is
700-foot high steel-arch bridge, spanning the Colorado River above ne
Glen Canyon Dam construction site, was opened to traffic in February,
1959. Before completion of the Bureau of Reclamation-designed bridge,
it was 200 miles from rim to rim by existing roads and a crossing at
Marble Canyon downstream. Outlet of one of the two large diversion
tunnels is shown lower left. Earth- and rock-fill cofferdams upstream
and downstream of the damsite permit unwatering of the foundation

diversion tunnels which will carry the entire flow of the Colorado
River around the dam site throughout the construction period. So
virtually completed was the excavation of the right and left abut-
ment keyways for the ends of the concrete arch dam. Ear
cofferdams were constructed upstream and downstream from
dam site to isolate the construction area from encroachment by
river, which was successfully diverted from its channel in February
1959. Excavation of foundation for the dam was about 50
below the original stream bed by the end of the year. First concrete
for the dam, which will have a volume of more than 5 million
yards, is expected to be placed in the dam in 1960. The con

or construction of the dam and the 900,000-kilowatt Glen Canyon powerplant is now about 27 percent completed.

New Arizona Community

Also completed on the Glen Canyon Unit were 200 residences, an administration building, fire station, and police building for the new community of Page, Ariz., near the damsite. Completed also were the community's streets and water supply and sewerage systems.



Scaling operations at rugged Flaming Gorge Damsite—Construction workers scale off loose dirt and rock from the sheer walls of the Flaming Gorge Damsite near the Utah-Wyoming border. The contractor's construction bridge across the Green River at lower left carries a concrete pipeline used in conveying concrete for lining of the diversion tunnel. The 495-foot arch-type concrete dam and 91-mile-long Flaming Gorge reservoir will be a major storage unit of the Colorado River Storage project.

During the year, construction of access roads to the Flam Gorge dam site on the Green River in northeastern Utah was progress. Excavation of the diversion tunnel was completed April 1959, and diversion of the river is expected to be made ea in the fall of 1959. Construction was completed on 50 residences and streets at Dutch John, Utah, the new Government community near the dam site.

The 1,425-kilowatt Wanship Powerplant and the 4,500-kilowatt Gateway Powerplant on the Weber Basin project in Utah were completed and placed in commercial operation during the fiscal year. Also completed were the project's West Farmington and Westcross trunkline pipelines of the Davis Aqueduct and 20 miles of Uintah Bench laterals of the Weber Aqueduct. Essentially completed was the first stage of the earth-fill Willard Dam, which will create a fresh water reservoir along the east shore of Great Salt Lake.

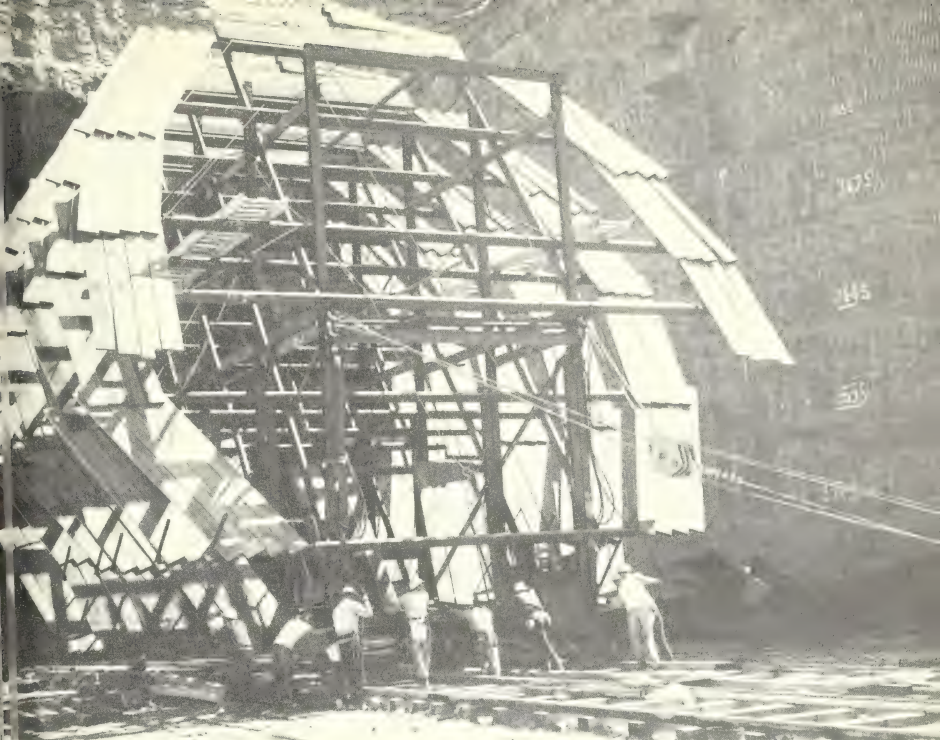
In western Colorado, construction of the earthfill Vega Dam on the Collbran project was virtually completed, and the South Tunnel was about one-third finished. Construction of a 21-mile section of the Southside Canal and of the Upper and Lower Montezuma Powerplants (8,400 kilowatts and 4,600 kilowatts, respectively) and the 5½-mile long Bonham-Cottonwood pipeline was initiated this spring.

Work Begun on Navajo Dam

A significant undertaking in New Mexico was start of construction of Navajo Dam, a principal storage feature of the Colorado River Storage project. This large earthfill dam on the San Juan River will have a height of 408 feet and a volume of 26 million cubic yards. By June 30 construction was about 30 percent completed.

On the Washita Basin project in Oklahoma, construction of the earthfill Fort Cobb Dam also was several months ahead of schedule and is expected to be completed early in the next fiscal year. The 21-mile long Anadarko Aqueduct was started in May. Construction of the Foss Dam, was about 35 percent completed with about 1½ million of the required 11 million cubic yards of earthfill in place.

On the Glendo unit of the Missouri River Basin project in Wyoming, construction of the 48,000-kilowatt Fremont Canyon Powerplant, and the 3-mile-long, 18-foot-diameter power conduit advanced to about 85 percent of completion. The conduit was "holed through" in December 1958, and placement of concrete lining was begun. Also in Wyoming, construction of the 203-foot-high, concrete-arch Arrow Dam on the Owl Creek Unit of the Missouri River Basin project was about two-thirds ready.



The dam is building Paul Bunyan-sized tunnels. *Top:* workmen at
 Glen Canyon Dam start a huge "jumbo," or working platform for tunnel
 excavation toward mouth of left spillway tunnel, which will range
 from 50 feet in diameter near inlet to 41 feet in diameter at the outlet.
Bottom: construction advances on 18-foot-9-inch diameter outlet tunnel
 at Navajo Dam, a 395-foot earthfill structure on the San Juan River
 in New Mexico. Both are units of the Colorado River Storage project.



The Helena Valley Unit of the Missouri River Basin project in Montana noted completion of the 2.6-mile long, 7-foot-diameter Helena Valley Tunnel and the Helena Valley Pumping Plant. Completed also were 37 miles of the Helena Valley Canal and laterals.

On the Missouri River Basin's Bostwick Division in Kansas, 10 miles of the Courtland West Canal and laterals were completed, and construction of 5.5 miles of the White Rock Canal was about 90 percent completed. Also in Kansas, on the Kirwin Unit, the Weston Diversion Dam and a 6-mile long section of the Osborne Canal were finished. Work was started on a 14-mile-long section of the canal together with laterals and small pumping plants.

In Nebraska, progress on the Frenchman-Cambridge Division included completion of 28 miles of the Driftwood West Canal, laterals, sublaterals, wasteways and drains, and 22 miles of the Driftwood Canal, subcanal, laterals, and drains. Rehabilitation of the Culbertson Canal Diversion Dam and reconstruction of the first 6 miles of the old Culbertson Canal was finished and reconstruction of an additional 14 miles of the canal was initiated.

The Transmission Division of the Missouri River Basin project was advanced to 85 percent of completion by the construction of footings and towers for the 165-mile, 230-kilovolt steel tower transmission line between Fargo, N. Dak., and Granite Falls, Minn. Completed was the 67-mile, 230-kilovolt Utica Junction-Sioux Falls transmission line in South Dakota. Work reached the midway point of completion on the 310-mile, 230-kilovolt steel tower transmission line which extends from the Fort Peck Powerplant in Montana to Bismarck, N. Dak. Construction started late in the fiscal year on the 37-mile, 115-kilovolt transmission line from the Boysen Powerplant to Pilot Butte Powerplant in Wyoming.

Emphasis on Safety Program

The Bureau continued to emphasize its safety program aimed at prevention of personal injuries through use of modern safety practices and other preventive measures against construction hazards. Significant progress was made by reducing the accident frequency rate 7 percent below last year's level. The overall frequency rate was kept well below average for heavy construction, despite the fact that high hazard tunnel work accounted for more than 12 percent of the total man-hours worked.

Major construction and supply contracts (more than \$1,000,000 each) awarded by the Bureau are listed in table 1.

Principal features completed on Bureau of Reclamation projects are shown in table 2.

TABLE 1.—Major Bureau of Reclamation contracts awarded in fiscal year 1959

| Feature | Project | Amount of award |
|--|------------------------|-----------------|
| Dam | Washita Basin | \$7,351,557 |
| and Dam, second stage | Weber Basin | 4,606,260 |
| stocks and outlet pipes for Glen Canyon Dam | Colorado River Storage | 3,778,000 |
| Paonia Dam and relocation of 4.4 miles of State highway | Paonia | 3,167,175 |
| ville Dam | Crooked River | 2,614,943 |
| er and Lower Molina Powerplants, Penstocks, and Equalizing Reservoir | Collbran | 2,425,247 |
| ing Flaming Gorge Reservoir, first phase | Colorado River Storage | 2,385,000 |
| am and Cottonwood Pipelines | Collbran | 1,669,358 |
| r Dam | Central Utah | 1,658,833 |
| rator for Unit N-8, Hoover Powerplant | Boulder Canyon | 1,601,200 |
| les of Southside Canal | Collbran | 1,598,349 |
| ing conductors and overhead ground wires for 165-mile | Missouri River Basin | 1,524,647 |
| go-Granite Falls 230-kilovolt transmission line | do | 1,513,367 |
| es-Cheyenne 115-kilovolt transmission line, 140 miles | do | 1,447,700 |
| tations and steel towers for 100 miles of Bismarck- | do | 1,434,548 |
| a-town 230-kilovolt transmission line | Boulder Canyon | 1,422,800 |
| iles of Osborne Canal and 17 miles of laterals and drains | Washita Basin | 1,372,551 |
| aultic turbine for Unit N. 8, Hoover Powerplant | Central Valley | 1,321,341 |
| iles of Anadarko Aqueduct | Missouri River Basin | 1,322,448 |
| cation of 5.5 miles of Trinity County Road | do | 1,215,273 |
| iles of North and East Side Laterals and 18.1 miles of | Little Wood River | 1,093,945 |
| ns | | |
| les of Block 82 laterals, wasteways, and drains | | |
| using height of Little Wood River Dam | | |

TABLE 2.—Principal features completed on Bureau of Reclamation projects in fiscal year 1959

| Feature | Project | State |
|--|------------------------|---------------|
| ke Siphon | Columbia Basin | Washington. |
| as canals, laterals, wasteways, and drains | do | Do. |
| d Prairie Dam | Rogue River | Oregon. |
| is of delivery canal and collection canals | do | Do. |
| reek Diversion Dam | do | Do. |
| owerplant | Yakima | Washington. |
| is of pipelines for Southern San Joaquin Muni- | Central Valley | California. |
| e Utility District | | |
| uell Dam | Santa Maria | Do. |
| is of Putah South Canal | Solano | Do. |
| a Dam | Ventura | Do. |
| e Diversion Dam | do | Do. |
| e Robles-Casitas Diversion Canal | do | Do. |
| s Ventura distribution system pipelines | do | Do. |
| l water tanks | do | Do. |
| munity facilities for Flaming Gorge Dam | Colorado River Storage | Utah. |
| lo River Bridge | do | Arizona. |
| ndences for Page, Ariz | do | Do. |
| supply system for Page, Ariz | do | Do. |
| is of Uintah Bench pipe laterals | Weber Basin | Utah. |
| p and Gateway Powerplants | do | Do. |
| e pipeline for Davis Aqueduct trunklines | do | Do. |
| s Farson—West Side laterals and drains | Eden | Wyoming. |
| e channelization of Rio Grande | Middle Rio Grande | New Mexico. |
| Valley Tunnel | Missouri River Basin | Montana. |
| Valley Pumping Plant | do | Do. |
| e of Helena Valley Canal and laterals | do | Do. |
| e Utica Junction-Sioux Falls 230-kilovolt trans- | do | South Dakota. |
| s in line | | |
| Thompson Powerplant | Colorado-Big Thompson | Colorado. |
| e of Courtland West Canal and laterals | Missouri River Basin | Kansas. |
| e of Driftwood and Meeker Extension canals | do | Nebraska. |
| s of Culbertson Canal laterals, and drains | do | Do. |
| e Powerplant | do | Wyoming. |
| s on Diversion Dam | do | Kansas. |
| s Osborne Canal | do | Do. |

Design and Research Progress

Increased emphasis was given during the year to utilizing automatic computing devices in design work. A comprehensive program was developed to utilize an electronic computer in determining cut and earthwork quantities and related information. Such machine processing of data led to considerable savings in time and effort in computing required quantities. Electronic computer techniques were also developed to solve a variety of technical problems in study of operations of multiple-purpose hydrology systems, determining the sediment load in streams, determining temperatures in concrete dams and reducing field data from tests on large hydraulic and electrical machines.

Design developments led to the method of disposing of high sediment loads in the Peralta Main Canal of the Middle Rio Grande project in New Mexico through use of a hydraulic dredge. The dredge will operate in a settling basin which is to be constructed near the canal headworks at the Isleta Diversion Dam on the Rio Grande. The dredge will have an operating capacity of 110 cubic yards an hour. Sediment dredged from the settling basin will be discharged at selected spoil areas along the bank of the Rio Grande.

Other design innovations developed during the year included a water stoplog design for stopping the flow of water through the diversion tunnel at Flaming Gorge Dam. Outlet gates, 7 feet wide by 12 feet high, for heads up to 350 feet (highest head gates of this size and type to be designed by the Bureau), were designed to regulate discharges through the left diversion tunnel at Glen Canyon Dam. A new method of counterweight suspension was developed for the spillway gates at Glen Canyon Dam, which will make possible appreciable savings in construction costs.

Designs were completed during the year and construction began on the earthfill Sheep Creek Barrier Dam in the Paria River Basin in Utah, the first dam to be undertaken by the Bureau of Reclamation for the sole purpose of retaining sediment. The Paria River Basin was formerly a fertile meadow, but because of extensive over-grazing during the early 1900's and damaging floods it became an unproductive, badly eroded area. Design and construction of the dam is part of a cooperative program of various Federal and State agencies to demonstrate that by building suitable structures and by proper soil and moisture conservation practices, the basin lands can be returned to former productivity.

Electrical Logging Trails Held

The first full-scale field trials of electrical logging to detect possible leakage from operating canals were made on the Central Valley project in October 1958. The method is an adaptation of drill pipe

logging which has widespread application in the oil industry. Electrical logging permits a continuous measurement and recording on a part of variations of the electrical resistance of materials making the bottom and/or banks of a canal. Logging has shown that water lowers the resistance of earth materials, and in those reaches of a canal where the resistance is low, leakage may be suspected. Identifying such reaches permits subsequent verification of the leakage and remedial measures as necessary.

Research in the Bureau's Denver engineering laboratories led to the first large-scale use of heavy media processing of concrete aggregates at Glen Canyon and Flaming Gorge Dams. Nearby aggregates at both sites contain soft, absorptive, lightweight particles that would produce poor quality concrete. The heavy media separation process removes the undesirable lightweight material from the aggregate by introducing the aggregate into a "heavy liquid" having a specific gravity between the specific gravities of desirable and objectionable aggregates. The light objectionable materials float to the surface and are carried off as waste products; the desirable aggregate sinks in the medium and is recovered for use in concrete.

Substantial progress was made in laboratory and field experiments with water-reducing retarding agents for concrete. The benefits from use of such agents include increased workability and reduction in cement content. For some concrete, particularly that pumped for tunnel lining, the agents have further advantage in permitting the concrete to remain plastic for an extended period. One of these agents was used in the concrete of the Glen Canyon Dam diversion tunnels.

New Techniques in Hydraulic Research

In hydraulic research, new techniques were developed to dissipate the energy contained in jets issuing from controls in high head outfalls. Data were derived in the Hydraulic Laboratory for revised discharge tables for the constant head orifice turnout originally developed by the Bureau.

Aquatic weed control investigations, which have been conducted at the Denver laboratories for a number of years in collaboration with the Agricultural Research Service, were significantly expanded by the initiation of a series of investigations in California aimed specifically at developing economic and effective means of controlling aquatic weeds in large canals conveying up to 5,000 cubic feet per second. A laboratory method was developed for the evaluation of emulsifying agents for aromatic solvent water-weed sprays, which would result in a savings of about 25 percent in the use of emulsifiers.

A contraction joint simulator, devised in the laboratories, represents a significant advance in test methods for joint sealing materials.



This water-stealing plant "wanted" by western authorities—This thriving velvet mesquite, photographed on the banks of Arizona's Gila River, is a phreatophyte, one of many water-stealing plants which invade canals and reservoir areas in western states. It is estimated that phreatophytes infest more than 15 million acres in the 17 western states and that they transpire at least 25 million acre feet of water annually—almost enough to fill Lake Mead. The Bureau of Reclamation directs research and control measures against these plant pests.

proposed for use in concrete structures such as powerhouses and irrigation canals. The contraction joint simulator tests the materials under conditions closely approximating the field service at an accelerated rate, thus permitting quick and accurate evaluation in advance of use.

Cooperative studies of the water consumption by salt cedar (tamarisk) conducted by the Bureau of Reclamation and the Department of Geological Survey continued at a 10-acre site near Buckeye, Arizona. The studies are expected to be significant not only in the control of the objectional phreatophyte (water stealing) plants which infest large areas of certain river basins in the Southwest, but also in the development of techniques to study the water consumption of beneficial crops raised on irrigated projects. The studies utilize lysimeters, 33-foot square by 10-foot deep tanks placed in the ground

d in which salt cedar plants have been transplanted for observation of growth with water levels maintained at different depths. During the year, 113 laboratory reports were issued covering hydraulic laboratory investigations, structural studies, research in sediment control, dimineralization of saline water, and water evaporation, and research and testing of concrete and concrete materials, asphalt and bituminous materials, and protective coatings.

Foreign manufacturers' interest in Bureau of Reclamation equipment advertisements continued. A total of 18 contracts, principally for electrical equipment, was awarded to companies offering equipment manufactured outside the United States. This compares with 17 contracts awarded to foreign manufacturers in fiscal year 1958, and 26 in 1957. The 1959 contracts, which totaled \$899,076, were awarded to 6 Swiss, 5 English, 3 West German, 2 Austrian, 1 French, and 1 Italian firm. The required differential was added to foreign bids for comparison with domestic bids.

Construction Costs Increase

Construction costs on Bureau of Reclamation projects increased about 21½ percent during the year. Most of this increase occurred during the first half of the year. For the same period, construction labor rates and costs of materials increased from 3 to 5 percent.

Adding interest in Reclamation construction work was more than 1 percent higher than the average for the past 10 years, and about 1 percent higher than the average for last year. An average of 10 bids per construction schedule was received. The average low bid was 13 percent under the Bureau's engineers' estimates for all construction schedules advertised.

Table 3 shows cost indexes for Bureau of Reclamation construction based on the combined costs of materials and labor supplied by contractor, and materials and labor supplied by the Government.

Technical Records Published

Published during the year were the technical records on the design and construction of Monticello Dam and the Potholes East Canyon. Also published were two engineering monographs, describing respectively, the structural behavior of Hungry Horse Dam and the hydraulic design of stilling basins and bucket energy dissipators. Completed and scheduled for issuance early in fiscal year 1960 were technical records on the design and construction of the Cachuma Dam, Tecolote Tunnel, Delta-Mendota Canal, and the Tracy Pumping Plant.

TABLE 3.—*Bureau of Reclamation construction indexes, fiscal year 1959*

| Cost indexes based on January 1940 costs=1.00 | | July 1958 | January 1959 | July 1959 |
|---|--|--------------|-----------------|--------------|
| Dams: | | | | |
| Earth..... | | 2.20 | 2.24 | |
| Concrete..... | | 2.36 | 2.38 | |
| Pumping plants: | | | | |
| Building and equipment..... | | 2.93 | 3.03 | |
| Structures and improvements ¹ | | 3.05 | 3.07 | |
| Equipment..... | | 2.90 | 2.99 | |
| Pumps and prime movers..... | | 3.02 | 3.11 | |
| Accessory electric and miscellaneous equipment..... | | 2.70 | 2.79 | |
| Steel penstocks and discharge pipes..... | | 3.55 | 3.75 | |
| Canals and conduits: | | | | |
| Canals..... | | 2.44 | 2.44 | |
| Conduits (tunnels, free-flow, concrete-lined)..... | | 2.89 | 2.92 | |
| Laterals and drains..... | | 3.07 | 3.19 | |
| Powerplants, hydro: | | | | |
| Building and equipment..... | | 2.85 | 2.99 | |
| Structures and improvements ¹ | | 3.03 | 3.06 | |
| Equipment..... | | 2.89 | 2.95 | |
| Turbines and generators..... | | 2.88 | 2.95 | |
| Accessory electrical equipment..... | | 2.74 | 2.80 | |
| Miscellaneous equipment..... | | 2.73 | 2.81 | |
| Concrete pipelines..... | | 2.42 | 2.43 | |
| Transmission switchyards and substations..... | | 2.89 | 2.98 | |
| Transmission lines (wood-pole 115-kilovolt)..... | | 2.44 | 2.48 | |
| Transmission lines (steel tower 230-kilovolt)..... | | 2.67 | 2.75 | |
| Permanent general property: | | | | |
| Buildings..... | | 2.98 | 3.05 | |
| Roads and bridges: | | | | |
| Primary roads..... | | 2.52 | 2.58 | |
| Secondary roads, unsurfaced..... | | 2.34 | 2.36 | |
| Bridges (steel)..... | | 3.14 | 3.23 | |
| Composite index..... | | 2.63 | 2.71 | |

¹ Indexes for structures and improvements on pumping plants and powerplants are based on a reinforced concrete structure.

Water Use and Land Utilization

The irrigation systems of Reclamation projects embrace 8,049,200 acres of land in the 17 Western States. The 79 irrigation projects serve more than 128,000 farms. These fertile, well-watered farmlands stand out in sharp contrast with the adjacent dryland areas. They provide a feed base which plays the key role in stabilizing the rangeland livestock economy. They provide for the displacement of the population from the arid and semiarid areas of the Nation, as well as for the West itself, large quantities of fruits and vegetables, which provide nutritious diversity to the American diet. These project areas are important hubs of trade and commerce throughout the 17-state Reclamation West, and the livelihoods and investments of a sizeable share of the population of that area are influenced by irrigation farming and its associated enterprises.

Irrigation Service

The acreage irrigated on Reclamation projects increased 19,711 acres in 1958. This brought to 6,756,737 the total acreage irrigated. Irrigation service was initiated in 1958 on the Chief Joseph project and the Michaud Flats project. Supplemental water service was made available on the Glendo Unit of the Missouri River project.

POPULATION GROWTH IN RECLAMATION STATES

from 41 million in 1957 to

60 million in 1975

PACIFIC COAST
STATES UP 64%

MOUNTAIN
STATES UP 43%

PLAINS
STATES
UP 29%

130 million in 2010

PACIFIC
COAST
UP 310%

MOUNTAIN
STATES UP 217%

PLAINS
STATES
UP 115%

TOTAL U.S. IN 1975-230 million (up 35%)
2010-370 million (up 118%)

Based on Dept. of Commerce data

Reclamation provides water for the nation's fastest growing area—Water developed by Bureau of Reclamation facilities has been a major factor in making possible the tremendous postwar population and industrial growth in the West. This table shows that this area is maintaining its rate of growth making additional development of the area's key resource—fresh water—a continuing, high priority requirement.

Full irrigation service, wherein the complete water supply is provided through works constructed or rehabilitated by the Bureau, was provided to 3,407,057 acres. A supplemental water supply was furnished to 3,254,388 acres. Temporary water service arrangements covered 95,292 acres of irrigated land.



Reclamation orchards create oases in semiarid Southwest—Acreage of Reclamation projects planted to fruit and nut trees increased 18 per cent between 1954 and 1958. Total production of fruit and nut crops now exceeds 2 million tons annually. These thriving citrus and avocado orchards are in the Ojai Valley of California's Ventura River project.

Crop Production

The total value of all crops grown on Reclamation projects in 1958 was \$987,441,504 bringing the cumulative total since the initiation of the Federal Reclamation program to \$14.2 billion. (See Table 4.) This aggregate value is almost 5 times the net investment.

TABLE 4.—*Acreage and gross crop value, 1958*

| Crop group | Irrigated crops | | Gross crop value | |
|-------------------------------------|-----------------|------------------|------------------|------------------|
| | Acres | Percent of total | Dollars | Percent of total |
| Cereals..... | 1, 756, 021 | 25.99 | \$110, 841, 789 | 11.22 |
| Forage..... | 3, 019, 481 | 44.69 | 161, 267, 551 | 16.33 |
| Miscellaneous field crops..... | 1, 267, 618 | 18.76 | 318, 754, 604 | 32.28 |
| Vegetables..... | 489, 346 | 7.24 | 165, 001, 932 | 16.71 |
| Seeds..... | 233, 864 | 3.46 | 28, 296, 059 | 2.87 |
| Fruits, nuts and miscellaneous..... | 324, 992 | 4.81 | 176, 371, 741 | 17.85 |
| Other ¹ | | | 26, 907, 828 | 2.73 |
| Total reported..... | 7, 091, 322 | 104.95 | | |
| Less: Multiple cropped..... | 480, 426 | 7.11 | | |
| Plus: | | | | |
| Soil building crops..... | 27, 264 | .40 | | |
| Cropland not harvested..... | 118, 577 | 1.76 | | |
| Total..... | 6, 756, 737 | 100.00 | 987, 441, 504 | 100.00 |

¹ Additional revenues from Federal and commercial agencies.

the U. S. Government in Reclamation project facilities, which not only irrigate but also the associated functions of flood control, hydroelectric power, municipal and industrial water, river regulation for pollution abatement, fish and wildlife, and other purposes.

The crop value in 1958 was nearly \$60 million greater than for the previous year and exceeded the previous record year of 1952 by \$10 million. The per-acre value averaged \$146.14, but ranged up to \$681.70 per acre on a total project basis. (See Table 5.) The highest average per-acre value for a single crop was \$1,620 for alfalfa. Other specialty crops averaging more than \$1,000 per acre were cucumbers, green onions peppers, and dates.

Water for the semiarid West—Bureau of Reclamation storage dams impound spring flood waters and surplus runoff of western streams for release for multiple-purpose use when natural stream flow has been reduced or dried up entirely. Some large storage reservoirs like Hoover Dam's Lake Mead and the Glen Canyon Dam and Reservoir, now under construction, will store water many years for use in prolonged dry periods. This is a view of Canyon Ferry Dam and Reservoir in Montana, a major part of the multiple-purpose Missouri River Basin Project.



[illegible]

TABLE 5.—*Irrigation and gross crop value data by type of irrigation service for each State, 1958—Continued*

| State | Project and division | Full irrigation service | | Supplemental irrigation service | | Temporary irrigation service | | Total | |
|--------------|---|-------------------------|------------------|---------------------------------|------------------|------------------------------|------------------|----------------|----------------------------|
| | | Irrigated area | Gross crop value | Irrigated area | Gross crop value | Irrigated area | Gross crop value | Irrigated area | Gross crop value |
| | | | | | | | | | |
| New Mexico | | Acres | Dollars | Acres | Dollars | Acres | Dollars | Dollars | Average per acre irrigated |
| | Carlsbad..... | 19, 050 | 4, 396, 616 | | | 19, 050 | 4, 396, 616 | | 230. 79 |
| | Fort Sumner..... | 5, 333 | 442, 731 | | | 5, 333 | 442, 731 | | 83. 02 |
| | Middle Rio Grande..... | 54, 356 | 3, 871, 399 | | | 54, 356 | 3, 871, 399 | | 71. 22 |
| | Pine River (see also Colorado)..... | | | | | 940 | 25, 566 | | 27. 20 |
| | Rio Grande (see also Colorado)..... | 83, 923 | 24, 451, 683 | | | 83, 923 | 24, 451, 683 | | 291. 36 |
| | Tucumcari..... | 33, 554 | 2, 039, 524 | | | 33, 554 | 2, 039, 524 | | 60. 78 |
| | Vermejo..... | 4, 602 | 134, 268 | | | 4, 602 | 134, 268 | | 29. 18 |
| | Subtotal..... | 200, 818 | 35, 336, 221 | | | 201, 758 | 35, 361, 787 | | 175. 27 |
| North Dakota | | | | | | | | | |
| | Buford-Trenton..... | 6, 464 | 538, 932 | | | 6, 464 | 538, 932 | | 83. 37 |
| | Lower Yellowstone (see also Montana)..... | 16, 153 | 1, 283, 556 | | | 16, 153 | 1, 283, 556 | | 79. 46 |
| | Missouri River Basin: | | | | | | | | |
| | Heart Division: | | | | | | | | |
| | Dickinson unit..... | 332 | 23, 483 | | | 332 | 23, 483 | | 70. 73 |
| | Heart Butte unit..... | 524 | 23, 721 | | | 524 | 23, 721 | | 45. 27 |
| | North Dakota Pumping Division: Fort Clark unit..... | 1, 038 | 63, 406 | | | 1, 038 | 63, 406 | | 61. 08 |
| | Subtotal..... | 24, 511 | 1, 933, 098 | | | 24, 511 | 1, 933, 098 | | 78. 87 |
| Oklahoma | W. C. Austin..... | 41, 249 | 6, 579, 626 | | | 41, 249 | 6, 579, 626 | | 159. 51 |
| | Subtotal..... | 41, 249 | 6, 579, 626 | | | 41, 249 | 6, 579, 626 | | 159. 51 |
| | | | | | | | | | |
| Oregon | Arnold..... | 2, 634 | 93, 374 | | | 2, 634 | 93, 374 | | 35. 45 |
| | Baker..... | | | 7, 266 | 301, 206 | 7, 266 | 301, 206 | | 41. 45 |
| | Boise (see also Idaho)..... | 1, 455 | 97, 376 | | | 1, 455 | 97, 376 | | 66. 93 |
| | Burnt River..... | | | 15, 489 | 538, 895 | 15, 489 | 538, 895 | | 34. 79 |
| | Crescent Lake Dam..... | 6, 394 | 312, 043 | | | 6, 394 | 312, 043 | | 48. 80 |
| | Deschutes..... | 46, 597 | 4, 955, 772 | | | 46, 597 | 4, 955, 772 | | 83. 40 |
| | Grants Pass..... | 7, 455 | 846, 231 | 43, 983 | 2, 599, 019 | 90, 580 | 7, 554, 791 | | 113. 51 |
| | Owyhee (see also Idaho)..... | 10, 916, 962 | 10, 916, 962 | | | 7, 455 | 846, 231 | | 86. 90 |
| | Subtotal..... | 97, 218 | 9, 340, 590 | 14, 590 | 2, 360, 000 | 118, 735 | 10, 318, 566 | | 86. 90 |

| | 302,646 | 29,596,838 | 111,468 | 12,943,492 | 489 | 44,523 | 414,803 | 1,987,931 | 63,68 |
|--|-----------|-------------|-----------|-------------|--------|------------|---------|-------------|--------|
| Subtotal | 302,646 | 29,596,838 | 111,468 | 12,943,492 | 489 | 44,523 | 414,803 | 1,987,931 | 63,68 |
| Belle Fourche, Missouri River Basin: Cheyenne Division: Angostura unit | 54,413 | 1,966,116 | | | | | | 42,584,853 | 102,71 |
| Rapid Valley | 11,098 | 662,875 | 6,644 | 116,987 | | | 54,413 | 1,966,116 | 36,13 |
| Subtotal | 65,511 | 2,628,991 | 6,644 | 116,987 | | | 11,098 | 622,875 | 59,73 |
| Balmorhea, Rio Grande (see also New Mexico) | 56,879 | 16,926,346 | 5,426 | 950,015 | | | 6,644 | 116,987 | 17,61 |
| Subtotal | 56,879 | 16,926,346 | 12,270 | 2,823,733 | | | 72,155 | 2,745,978 | 38,06 |
| Hyrum | | | 5,380 | 294,862 | | | 5,426 | 950,015 | 175,09 |
| Moon Lake | | | 58,117 | 1,297,579 | | | 63,723 | 18,800,064 | 295,03 |
| Newton | | | 2,185 | 132,982 | | | 69,149 | 19,750,079 | 285,62 |
| Ogden River | | | 15,737 | 2,117,513 | | | 5,380 | 294,862 | 54,81 |
| Provo River | | | 37,674 | 3,375,568 | | | 58,117 | 1,297,579 | 22,33 |
| Sanpete | | | 11,999 | 415,200 | | | 2,185 | 132,982 | 60,86 |
| Scofield | | | 14,673 | 802,406 | | | 15,737 | 2,117,513 | 134,56 |
| Strawberry Valley | | | 21,464 | 1,681,629 | | | 37,674 | 3,475,568 | 92,25 |
| Weber River | 15,636 | 796,759 | 90,779 | 8,468,335 | 2,447 | 186,989 | 11,999 | 415,200 | 34,60 |
| Subtotal | 15,636 | 796,759 | 258,008 | 18,686,074 | 2,447 | 186,989 | 14,673 | 802,406 | 54,69 |
| Chief Joseph Dam | 878 | 224,734 | | | | | 39,547 | 2,685,377 | 67,40 |
| Columbia Basin | 238,312 | 27,302,370 | | | | | 90,779 | 8,468,335 | 93,29 |
| Okanogan | 3,897 | 774,116 | | | | | 276,091 | 19,669,822 | 71,24 |
| Yakima | 229,453 | 46,851,646 | 164,273 | 32,584,600 | 133 | 25,284 | 238,312 | 224,734 | 255,96 |
| Subtotal | 472,540 | 75,152,866 | 164,273 | 32,584,600 | 133 | 25,284 | 389,859 | 79,461,530 | 201,75 |
| Eden | 11,629 | 330,793 | | | | | 636,946 | 107,762,750 | 169,19 |
| Kendrick | 18,168 | 514,410 | | | | | 11,629 | 330,793 | 28,45 |
| Missouri River Basin: Bighorn Basin Division: Hanover-Bluff unit | 3,905 | 294,583 | 8,656 | 286,177 | | | 18,168 | 514,410 | 28,31 |
| Owl Creek unit | | | | | | | 3,905 | 294,583 | 75,44 |
| Oregon Trail Division: Glendo unit (see also Nebraska) | | | | | | | 8,656 | 286,177 | 33,06 |
| North Platte (see also Nebraska) | 51,857 | 4,109,201 | 7,556 | 412,357 | | | 7,556 | 412,357 | 54,57 |
| Riverton | 49,455 | 1,956,766 | 15,010 | 879,166 | | | 66,867 | 4,988,367 | 74,60 |
| Shoshone | 76,039 | 4,407,228 | | | | | 49,455 | 1,956,766 | 39,57 |
| Subtotal | 211,053 | 11,612,981 | 31,222 | 1,577,700 | | | 76,039 | 4,407,228 | 57,96 |
| Total all States | 3,407,057 | 504,740,954 | 3,254,388 | 463,999,003 | 95,292 | 18,701,547 | 242,275 | 13,190,681 | 54,45 |
| | | | | | | | | 6,756,737 | 146,14 |

TABLE 6.—*Acreage, production, and gross crop value by crops and type of crops—1958*

| Crops | Irrigated lands | | Tonnage | | Gross crop value | |
|---------------------------------------|-----------------|--------------------------|--------------|--------------------------|------------------|----------|
| | Total | Per- cent of total | Total | Per- cent of total | Total | ce to |
| Cereals: | <i>Acres</i> | <i>Per- cent</i> | <i>Tons</i> | <i>Per- cent</i> | <i>Dollars</i> | |
| Barley..... | 574, 508 | 8. 50 | 767, 349 | 2. 45 | 31, 028, 905 | |
| Corn..... | 310, 387 | 4. 60 | 593, 777 | 1. 90 | 24, 863, 306 | |
| Oats..... | 189, 242 | 2. 80 | 168, 396 | . 54 | 6, 632, 196 | |
| Rice..... | 7, 487 | . 11 | 15, 316 | . 05 | 1, 659, 068 | |
| Rye..... | 3, 141 | . 05 | 2, 212 | . 01 | 84, 281 | |
| Sorghums (sorgo, kafir, etc.)..... | 112, 706 | 1. 67 | 160, 864 | . 51 | 7, 389, 690 | |
| Wheat..... | 467, 174 | 6. 91 | 642, 684 | 2. 05 | 34, 314, 766 | |
| Other cereals..... | 91, 376 | 1. 35 | 129, 791 | . 41 | 4, 869, 577 | |
| Subtotal..... | 1, 756, 021 | 25. 99 | 2, 480, 389 | 7. 92 | 110, 841, 789 | |
| Forage: | | | | | | |
| Alfalfa hay..... | 1, 594, 768 | 23. 60 | 6, 138, 162 | 19. 61 | 103, 886, 801 | |
| Other hay..... | 203, 696 | 3. 02 | 422, 901 | 1. 35 | 6, 178, 650 | |
| Irrigated pasture..... | 972, 826 | 14. 40 | 2, 585, 800 | 8. 26 | 30, 059, 919 | |
| Corn fodder..... | 19, 188 | . 28 | 102, 922 | . 33 | 642, 000 | |
| Silage or Ensilage..... | 178, 307 | 2. 64 | 2, 961, 349 | 9. 46 | 17, 180, 483 | |
| Crop residue: | | | | | | |
| Beet tops..... | | | 1, 874, 561 | 5. 99 | 963, 790 | |
| Stubble, stalks, etc..... | | | 126, 794 | . 41 | 996, 128 | |
| Straw (all kinds)..... | | | 217, 510 | . 70 | 813, 343 | |
| Root crops (carrots, etc.)..... | 143 | | 1, 160 | | 7, 484 | |
| Other forage..... | 50, 553 | . 75 | 68, 045 | . 22 | 538, 953 | |
| Subtotal..... | 3, 019, 481 | 44. 69 | 14, 499, 204 | 46. 33 | 161, 267, 551 | |
| Miscellaneous Field Crops: | | | | | | |
| Beans, castor..... | 4, 128 | . 06 | 5, 102 | . 02 | 646, 523 | |
| Beans, dry and edible..... | 369, 533 | 5. 47 | 333, 185 | 1. 06 | 37, 853, 499 | |
| Broomcorn..... | 5, 699 | . 08 | 1, 362 | | 292, 552 | |
| Cotton, lint (Upland)..... | 440, 613 | 6. 52 | 221, 061 | . 71 | 153, 136, 818 | |
| Cotton, seed (Upland)..... | | | 359, 853 | 1. 15 | 15, 750, 695 | |
| Cotton, lint (American-Egyptian)..... | 42, 202 | . 63 | 11, 406 | . 04 | 11, 990, 256 | |
| Cotton, seed (American-Egyptian)..... | | | 22, 362 | . 07 | 1, 025, 007 | |
| Hops..... | 20, 402 | . 30 | 17, 379 | . 06 | 19, 785, 440 | |
| Peppermint..... | 12, 575 | . 19 | 588 | | 3, 919, 616 | |
| Spearmint..... | 3, 016 | . 05 | 145 | | 1, 077, 246 | |
| Sugar Beets..... | 364, 508 | 5. 39 | 6, 807, 696 | 21. 75 | 72, 864, 912 | |
| Other miscellaneous field crops..... | 4, 942 | . 07 | 5, 651 | . 02 | 412, 040 | |
| Subtotal..... | 1, 267, 618 | 18. 76 | 7, 785, 790 | 24. 88 | 318, 754, 604 | |
| Vegetables: | | | | | | |
| Asparagus..... | 15, 951 | . 24 | 20, 097 | . 06 | 4, 275, 212 | |
| Beans (processing)..... | 9, 045 | . 13 | 17, 030 | . 06 | 2, 070, 253 | |
| Beans (fresh market)..... | 479 | . 01 | 967 | | 233, 667 | |
| Broccoli..... | 698 | . 01 | 2, 155 | . 01 | 394, 440 | |
| Cabbage..... | 3, 876 | . 06 | 53, 884 | . 17 | 3, 110, 520 | |
| Carrots..... | 9, 459 | . 14 | 116, 016 | . 37 | 8, 849, 022 | |
| Cauliflower..... | 81 | | 616 | | 47, 901 | |
| Celery..... | 647 | . 01 | 16, 725 | . 05 | 1, 048, 355 | |
| Corn, sweet (processing)..... | 20, 543 | . 30 | 104, 623 | . 34 | 2, 194, 789 | |
| Corn, sweet (fresh market)..... | 7, 816 | . 12 | 21, 545 | . 07 | 2, 372, 926 | |
| Cucumbers..... | 2, 324 | . 03 | 22, 616 | . 07 | 2, 680, 472 | |
| Lettuce..... | 57, 929 | . 86 | 371, 643 | 1. 19 | 30, 685, 906 | |
| Melons: | | | | | | |
| Cantaloupes, etc..... | 27, 563 | . 41 | 180, 006 | . 58 | 13, 523, 277 | |
| Honey Ball, honeydew, etc..... | 2, 735 | . 04 | 32, 330 | . 10 | 1, 783, 332 | |
| Watermelons..... | 9, 605 | . 14 | 68, 909 | . 22 | 2, 976, 167 | |
| Onions, dry..... | 14, 168 | . 21 | 229, 124 | . 73 | 10, 530, 316 | |
| Onions, green..... | 636 | . 01 | 5, 105 | . 02 | 797, 565 | |
| Peas, green (processing)..... | 11, 767 | . 17 | 17, 184 | . 05 | 1, 492, 525 | |
| Peas, green (fresh market)..... | 1, 179 | . 02 | 2, 125 | . 01 | 495, 905 | |
| Peppers (all kinds)..... | 2, 535 | . 04 | 20, 118 | . 06 | 2, 671, 444 | |
| Potatoes, early..... | 52, 960 | . 78 | 634, 688 | 2. 03 | 12, 230, 315 | |
| Potatoes, late..... | 204, 891 | 3. 03 | 2, 159, 659 | 6. 90 | 39, 629, 170 | |
| Squash..... | 2, 588 | . 04 | 11, 197 | . 04 | 1, 207, 697 | |
| Sweet Potatoes..... | 909 | . 01 | 3, 729 | . 01 | 359, 583 | |

See footnotes at end of table.

TABLE 6.—*Acreage, production, and gross crop value by crops and types of crops—1958—Continued*

| Crops | Irrigated lands | | Tonnage | | Gross crop value | |
|---|-----------------|--------------------------|-------------|--------------------------|------------------|---------------------------------------|
| | Total | Per- cent of total | Total | Per- cent of total | Total | Per- cent of total ¹ |
| Vegetables—Continued | <i>Acres</i> | <i>Per- cent</i> | <i>Tons</i> | <i>Per- cent</i> | <i>Dollars</i> | <i>Per- cent</i> |
| Tomatoes (canning)..... | 15,361 | .23 | 173,374 | .55 | 4,263,698 | .43 |
| Tomatoes (fresh market)..... | 9,999 | .15 | 73,775 | .24 | 12,789,353 | 1.30 |
| Other vegetables..... | 3,602 | .05 | 25,097 | .08 | 2,288,122 | .23 |
| Subtotal..... | 489,346 | 7.24 | 4,384,331 | 14.01 | 165,001,932 | 16.71 |
| Nursery..... | 3,770 | .06 | | | 8,175,947 | .83 |
| Grasses: | | | | | | |
| Alfalfa..... | 92,168 | 1.36 | 19,090 | .06 | 10,686,175 | 1.08 |
| Clover (all kinds)..... | 37,041 | .55 | 7,235 | .03 | 4,165,340 | .42 |
| Corn..... | 5,079 | .08 | 6,316 | .02 | 987,942 | .10 |
| Flaxseed..... | 42,497 | .63 | 42,438 | .14 | 4,674,454 | .48 |
| Grass (all kinds)..... | 15,004 | .22 | 4,025 | .01 | 2,184,830 | .22 |
| Lettuce..... | 986 | .01 | 169 | | 252,785 | .03 |
| Onion..... | 726 | .01 | 205 | | 336,533 | .04 |
| Pea..... | 27,243 | .40 | 24,335 | .08 | 2,277,338 | .23 |
| Potato (all kinds)..... | 1,506 | .02 | 16,397 | .05 | 524,099 | .05 |
| Sugar beet..... | 2,508 | .04 | 3,761 | .01 | 1,091,325 | .11 |
| Other seed..... | 9,106 | .14 | 7,144 | .02 | 1,115,238 | .11 |
| Subtotal..... | 233,864 | 3.46 | 131,115 | .42 | 28,296,059 | 2.87 |
| Fruit: | | | | | | |
| Apples..... | 43,119 | .64 | 414,602 | 1.32 | 21,737,159 | 2.20 |
| Pricots..... | 7,562 | .11 | 43,873 | .14 | 3,886,725 | .39 |
| Cherries (all kinds)..... | 1,459 | .02 | 2,538 | .01 | 860,806 | .09 |
| Cherries..... | 6,138 | .09 | 19,884 | .06 | 4,811,307 | .49 |
| Citrus: | 17,157 | .25 | 121,307 | .39 | 7,874,984 | .80 |
| Grapefruit..... | | | | | | |
| Lemons and limes..... | 10,867 | .16 | 114,702 | .37 | 6,573,022 | .66 |
| Oranges and tangerines..... | 29,915 | .44 | 233,606 | .74 | 27,116,632 | 2.75 |
| Dates..... | 4,108 | .06 | 19,231 | .06 | 5,797,779 | .59 |
| Grapes, table..... | 56,508 | .84 | 350,381 | 1.12 | 31,621,298 | 3.20 |
| Grapes, other..... | 32,756 | .49 | 218,078 | .70 | 15,275,668 | 1.55 |
| Olives..... | 8,035 | .12 | 24,071 | .08 | 2,499,376 | .25 |
| Peaches..... | 25,768 | .38 | 169,124 | .54 | 10,870,218 | 1.10 |
| Pears..... | 25,249 | .37 | 215,605 | .69 | 12,991,518 | 1.32 |
| Prunes and plums..... | 9,291 | .14 | 51,476 | .16 | 5,456,719 | .55 |
| Other fruits..... | 3,394 | .05 | 8,194 | .03 | 1,118,259 | .11 |
| Subtotal..... | 281,326 | 4.16 | 2,006,672 | 6.41 | 158,491,470 | 16.05 |
| Nuts: | | | | | | |
| Almonds..... | 6,494 | .10 | 1,374 | .01 | 1,097,454 | .11 |
| Pecans..... | 5,126 | .08 | 2,813 | .01 | 1,938,630 | .20 |
| Walnuts..... | 5,599 | .08 | 4,221 | .01 | 1,597,284 | .16 |
| Other nuts..... | 157 | | 118 | | 47,100 | |
| Subtotal..... | 17,376 | .26 | 8,526 | .03 | 4,680,468 | .47 |
| Field gardens and orchards..... | 22,520 | .33 | | | 5,023,856 | .51 |
| Total all crops..... | 7,091,322 | 104.95 | 31,296,027 | 100.00 | 960,533,676 | 97.27 |
| Land multiple cropped..... | 480,426 | 7.11 | | | | |
| Total harvested cropland and pasture..... | 6,610,896 | 97.84 | | | | |
| Land not harvested..... | 118,577 | 1.76 | | | | |
| Soil building..... | 27,264 | .40 | | | | |
| Total irrigated..... | 6,756,737 | 100.00 | | | | |
| Additional revenues ² | | | | | 26,907,828 | 2.73 |
| Total gross crop value..... | | | | | 987,441,504 | 100.00 |
| Federal irrigation service..... | 3,407,057 | 50.42 | | | 504,740,954 | 51.11 |
| State irrigation service..... | 3,254,388 | 48.17 | | | 463,999,003 | 46.99 |
| Private irrigation service..... | 95,292 | 1.41 | | | 18,701,547 | 1.90 |

¹ Additional revenues are included in computing percentages.
² Includes payments received from Federal and commercial agencies.



Reclamation plays major role in western livestock economy—Feed grains and forage for livestock occupy seven-tenths of irrigated lands in the West. Reclamation projects and play a strategic role in enhancing and supplementing the productivity of Western range lands. These Herefords are being fattened on the Grand Valley project at Grand Junction, Colorado. Note the ensilage corn in the background.

The grain and forage crops which occupy about seven-tenths of the irrigated land provided 17 million tons of feed for use on the farms and ranches of the West (table 6). These feed crops, together with the specialty crops, the fruits, nuts, and vegetables, and the nurseries and home gardens complement the Nation's agriculture. Because of Reclamation, a better balance is attained in the total food and fiber production of the Nation.

Municipal and Industrial Water

Bureau of Reclamation projects provided 260 billion gallons of water for municipal and industrial and other nonirrigation use in 1958. This usage occurred on 32 projects involving 106 municipalities and 68 industrial entities.

More than two-thirds of this municipal and industrial water was furnished to the Metropolitan Water District of Southern California.

nia, a water utility district serving more than 75 cities, including Los Angeles and San Diego. Some of the other important cities receiving water service from Reclamation works include Salt Lake City, El Paso, Phoenix, Yuma, Las Vegas, Rapid City, Fort Collins, and Ogden.

About 8½ million persons live in the municipal and industrial water service entities which are served by the Bureau. These are in addition to the 790,000 persons who live on irrigated homesites on the fringes of the cities and towns on Reclamation projects. Nearly a half-million persons make up the farm families who reside on the project farms. Thus the daily activities of nearly 10 million persons are vitally affected by Reclamation water supplies.

Recreation Facilities and Usage

The 1½ million acres of water surface area at Reclamation reservoirs provide an opportunity for people to engage in a wide range

of water recreation for the semiarid West—Bureau of Reclamation reservoirs provide a total normal water surface area of 1½ million acres for boating, swimming, fishing and other water recreation. This picture shows a portion of the shoreline on the Bureau's Deer Creek Reservoir in Utah during the fishing season. Such "man-made" lakes are not only scenic attractions in the mountain-desert land, but also are among the outstanding fishing spots in the West today.



of water sports. About 19.5 million visitor days of use were recorded at Reclamation project areas in 1958. This was comprised as follows:

TABLE 7.—*Recreational visits to Bureau of Reclamation reservoirs, 1958*

| Activity | Visitor days |
|-------------------------------|--------------|
| Sightseeing..... | 7,180 |
| Fishing..... | 4,110 |
| Boating and water skiing..... | 2,500 |
| Picnicking..... | 2,170 |
| Swimming..... | 1,410 |
| Camping..... | 1,090 |
| Hunting..... | 330 |
| Other..... | 570 |
| Total..... | 19,450 |

The tremendous pressures of public visitations to the reservoirs which tripled in the past 8 years—reemphasize each year the need to provide the facilities which will adequately safeguard the visitors as well as the physical works themselves. On only a relatively small number of the projects has authority been provided to include public recreational facilities. For the greater majority of the projects, the entire cost and responsibility for installation and maintenance of public recreational facilities, if provided at all, rests with the organization responsible for recreational administration.

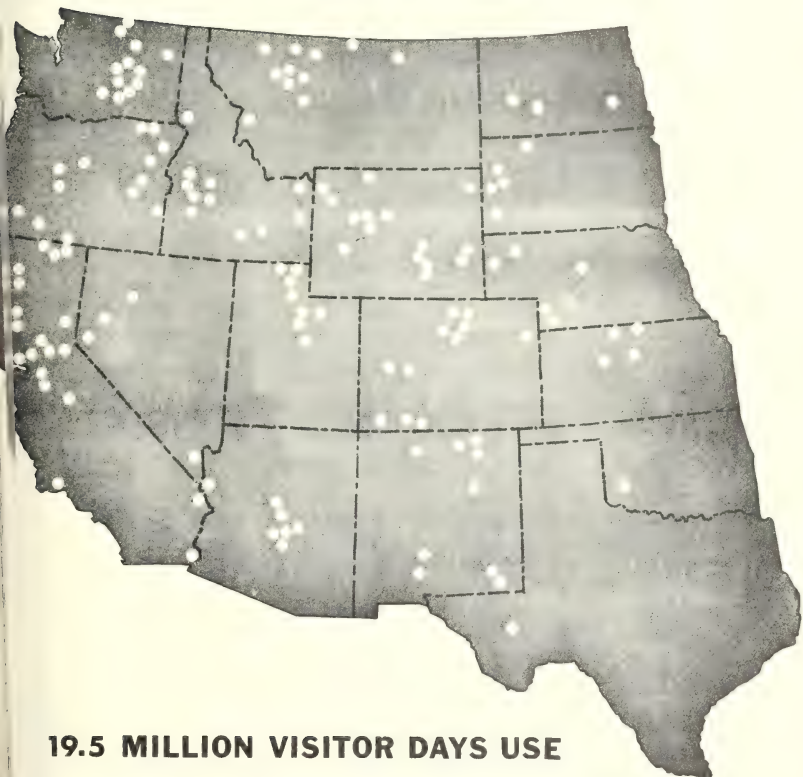
Repayment and Water Service Contracts

During fiscal 1959, more than 40 contracts were executed with various districts for the repayment of costs of Reclamation project works. Repayment, water service, and loan repayment contracts were executed for projects constructed under the terms and conditions of (1) general reclamation law; (2) Small Reclamation Projects program authorized by the Small Reclamation Projects Act of 1955; and (3) the Rehabilitation and Betterment Act of October 7, 1950. The largest contract executed during the year was for \$13,184,000 with the San Angelo Water Supply Corporation. A summary of the principal repayment and water service contracts executed is presented in table 8.

Only one small project loan repayment contract was executed prior to fiscal 1959. During the past fiscal year, six small project loan repayment contracts were executed with a total repayment obligation of \$10,099,000. Contract obligations vary from \$402,000 to \$3,510,000, and average about \$2,000,000. The maximum contribution by the Federal Government for a single project is limited by the authorizing legislation to \$5,000,000. Loan funds are

RECREATION

an extra dividend



19.5 MILLION VISITOR DAYS USE

Recreation—an extra dividend of reclamation—Dots on this map represent water recreation areas developed by the Bureau of Reclamation. These areas, which now provide more than 19½ million visitor days of recreational use, are a dividend of a western program that builds control facilities to develop water for other major purposes—essentially domestic, agricultural and industrial uses. Recreational administration of these areas normally is transferred to other Federal, State, and local public agencies.

...ced to a District only after the executed contract has been validated by appropriate court action. Also approved were the form of four additional loan repayment contracts, totaling \$11,045,000. Loan repayment periods vary between 22 and 50 years; however, none are for the authorized maximum 50-year period. Interest, currently at the rate 3½ percent annually, will be paid on the unamortized portions of the loans associated with the delivery of

TABLE 8.—*Repayment and water service contracts executed in fiscal year 1959*

| Project | Contracting parties | Type of contract ¹ | Contract repayment obligation | Repayment contract per |
|-----------------------|---|-------------------------------------|-------------------------------|--|
| | | | <i>Dollars</i> | <i>Years</i> |
| Arnold..... | Arnold Irrigation District..... | R&B..... | 45,000 | 18 |
| Boise..... | Individuals for purchase of space in Deadwood Reservoir. | Rpymt..... | 7,515.20 | 40 |
| Buford-Trenton..... | Buford-Trenton Irrigation District. | Amend. Rpymt..... | | (2) |
| Central Utah..... | Utah Water Conservancy District. | W/S & Rpymt..... | 1,500,000 | 50 |
| Central Valley..... | Tea Pot Dome Water District. | W/S & Distr. System Rpymt. | 1,800,000 | 40 |
| Do..... | El Dorado County (Water service to the Lake Hills Estate Water Maintenance District). | M&I W/S..... | (3) | 40 |
| Do..... | Proberta Water District..... | W/S..... | (3) | Until 1995 |
| Do..... | Lindsay-Strathmore I.D..... | Suppl. W/S..... | (3) | Until Dec. 1988 |
| Do..... | Madera Irrigation District..... | Suppl. Distr. System Rpymt. | 5,177,000 | 40 |
| Do..... | Romero Water District..... | W/S..... | (3) | Until 1995 |
| Do..... | San Luis Water District..... | W/S..... | (3) | Until 1995 |
| Do..... | Eagle Field Water District..... | W/S..... | (3) | Do. |
| Do..... | El Dorado Irrigation District. | Distr. System Rpymt. | 4,000,000 | 40 |
| Do..... | Oro Loma Water District..... | W/S..... | (3) | Until 1995 |
| Do..... | Stone-Corral Irrigation District. | Amend. W/S..... | 1,888,000 | 40 |
| Do..... | Delano-Earlimart I.D..... | Amend. (W/S..... | (3) | (3) |
| Do..... | Summit City Public Utility District. | Amendatory, M&I W/S..... | (3) | (3) |
| Do..... | Lindsay-Strathmore I.D..... | Amend. W/S..... | (3) | (3) |
| Do..... | Lindmore Irrigation District. | Amend. W/S..... | (3) | (3) |
| Do..... | Ivanhoe Irrigation District..... | Amend. W/S..... | (3) | (3) |
| Crooked River..... | Hudspeth Land & Livestock Co. | Rpymt..... | 73,920 | 50 |
| Lower Rio Grande..... | Hidalgo and Cameron Counties Water Control and Improvement District No. 9. | Rpymt..... | 10,800,000 | 35 |
| Milk River..... | {Malta Irrigation District..... | R&B..... | 143,418 | {Beginning and continued until option paid |
| | {Glasgow Irrigation District..... | R&B..... | 60,720 | |
| Missouri River Basin. | Clark Canyon Water Supply Co. | W/S..... | 1,160,000 | 40 |
| Do..... | East Bench Irrigation District. | W/S & Rpymt..... | 1,744,000 | 40 |
| Do..... | H&RW Irrigation District..... | Amend. W/S and Distr. System Rpymt. | (2) | (2) |
| Do..... | Angostura Irrigation District. | Amend. W/S..... | (2) | (2) |
| Do..... | Kirwin Irrigation District No. 1. | Amend. Rpymt..... | (2) | (2) |
| Do..... | City of Helena..... | W/S..... | (3) | (3) |
| North Platte..... | Pathfinder Dam Outlet Works (Several Contractors). | R&B..... | 180,000 | 5 |
| Orland..... | Orland Unit Water Users' Association | R&B..... | 250,000 | 30 |
| Rio Grande..... | El Paso County Water Improvement District No. 1 | R&B..... | 2,300,000 | 5 |
| Rogue River..... | Rogue River Valley I.D..... | Rpymt. & R&B..... | 580,500 | 60 |
| Do..... | Medford Irrigation District. | Rpymt. & R&B..... | 964,000 | 60 |
| Salt River..... | Salt River Valley Water Users' Association | R&B..... | 8,000,000 | 30 |
| San Angelo..... | San Angelo Water Supply Corp. | Rpymt..... | 4 13,184,000 | 40 |
| Do..... | Tom Green County Water Control and Improvement District No. 1. | Rpymt..... | 4,000,000 | 40 |
| Shoshone..... | Heart Mountain Irrigation District | Rpymt..... | 7,000,000 | 121 |
| Small projects..... | South Davis County Water Improvement District. | Loan Rpymt..... | 634,000 | Not to exceed 40 years |
| Do..... | Walker River I.D..... | Loan Rpymt..... | 563,000 | 40 |
| Do..... | Bountiful Subconservancy District | Loan Rpymt..... | 3,510,000 | 50 |

See footnotes at end of table.

TABLE 8.—*Repayment and water service contracts executed in fiscal year 1959—Continued*

| Project | Contracting parties | Type of contract ¹ | Contract repayment obligation | Repayment or contract period |
|---------------|--|-------------------------------|-------------------------------|------------------------------|
| | | | <i>Dollars</i> | <i>Years</i> |
| projects..... | Goleta County Water District | Loan Rpymt..... | 2,080,000 | 40 |
| o..... | Roosevelt Water Conservation District. | Loan Rpymt..... | 2,780,000 | 22 |
| o..... | Centerville-Deuel Creek Irrigation Company | Loan Rpymt..... | 402,000 | 48 |
| tiver..... | Fort Shaw Irrigation District | R&B..... | 100,000 | 10 |
| ncari..... | Arch Hurley Conservancy District | Amend. Rpymt.... | (2) | Variable |
| illa..... | Contracts with individuals McKay Reservoir | Rpymt..... | 56,520 | Various |
| ia..... | Kennewick Irrigation District | Amend. Rpymt.... | (2) | (2) |

Types of contracts are: W/S (water service); Rpymt. (repayment); R&B (rehabilitation & betterment); Loan Rpymt. (loan repayment).

¹ Change in repayment obligation and/or repayment period.

Water service contract.

(2) Interest.

to excess land holdings under the provisions of Reclamation, or for nonagricultural water service.

On contracts were executed by the Secretary of the Interior during the past year for the rehabilitation and betterment of facilities of existing Federally authorized Reclamation projects. These contracts comprise work having a total unmatured repayment obligation value of \$11,718,000. Repayment schedules for rehabilitation and betterment work are adapted to the needs of the contractors by recognizing prior repayment commitments. Consequently, repayment periods for these contracts vary from as little as 5 years to as much as 60 years. The contract with the Salt River Water Users' Association is the largest R&B repayment contract executed in the Bureau's history. Work covered by the \$8 million contract will be paid out over a period of 8 years and will be repaid by the Association in 30 years.

Three Public Law 130 distribution system loan repayment contracts were approved as to form during fiscal 1959. Two of these contracts have been executed by the districts and will be executed on behalf of the United States as soon as funds for distribution system construction loans are made available. The two loan contracts constitute a total repayment obligation of \$7,300,000. The maximum permissible loan repayment period under the distribution system loan act is limited to 40 years.

The 9 shows that the total value of all repayment contracts on June 30, 1959, amounted to \$916,073,149. Of this amount a total of \$142,483,214 has been repaid and delinquencies were insignificant. In addition, over \$125 million will be returned to the Government for water service payments under contracts now in force.

TABLE 9.—*Repayment contracts—matured and unmatured, June 30, 1959*

| Project and State | Value of repayment contracts | | | Unmatured value of repayment contracts | | | | Matured value of repayment contracts | Amount due and unpaid |
|--|------------------------------|---------------------------------------|---------------|--|---------------------|---------------------------------------|---------------|--------------------------------------|-----------------------|
| | Construction | Rehabilita- tion and betterment | Total | Construction | Deferred charges | Rehabilita- tion and betterment | Total | | |
| PROPERTY TITLED IN UNITED STATES | | | | | | | | | |
| Avondale, Idaho..... | \$244,423.61 | | \$244,423.61 | \$238,828.15 | | | \$238,828.15 | \$5,595.46 | |
| Baker, Oregon..... | 225,014.54 | | 225,014.54 | 75,006.14 | \$20,193.25 | | 95,199.39 | 129,815.15 | |
| Balmorhea, Texas..... | 255,600.00 | | 255,600.00 | 226,611.50 | | | 226,611.50 | 28,988.50 | |
| Belle Fourche, South Dakota..... | 4,230,059.65 | | 4,230,059.65 | 2,601,025.95 | | | 2,601,025.95 | 1,629,033.70 | |
| Bitter Root, Montana..... | 1,052,741.05 | \$225,000.00 | 1,277,741.05 | 650,057.60 | | \$213,750.00 | 863,807.60 | 413,933.45 | |
| Boise, Idaho-Oregon..... | 28,276,092.06 | 2,225,000.00 | 30,501,092.06 | 13,794,578.41 | 976,321.14 | 2,225,000.00 | 16,995,899.55 | 13,505,192.51 | \$80.00 |
| Boulder Canyon, All-American Canal System, California..... | 52,444,205.61 | | 52,444,205.61 | 50,674,253.24 | | | 50,674,253.24 | 1,769,952.37 | |
| Buffalo Rapids, Montana..... | 1,376,326.20 | | 1,376,326.20 | 1,264,168.66 | | | 1,264,168.66 | 112,157.54 | |
| Burnt River, Oregon..... | 599,735.00 | | 599,735.00 | 299,856.72 | | | 299,856.72 | 299,878.28 | |
| Carachuma, California..... | 5,653,221.92 | | 5,653,221.92 | 5,645,550.64 | | | 5,645,550.64 | 7,671.28 | |
| Carlsbad, New Mexico..... | 3,721,944.04 | 25,000.00 | 3,746,944.04 | 1,679,093.00 | 64,070.00 | 21,500.00 | 1,764,663.00 | 1,982,281.04 | |
| Central Utah, Vernal Unit, Utah..... | 1,500,000.00 | | 1,500,000.00 | 1,500,000.00 | | | 1,500,000.00 | | |
| Central Valley, California..... | 75,771,022.35 | | 75,771,022.35 | 75,020,074.27 | | | 75,020,074.27 | 750,948.08 | |
| Chief Joseph Dam, Foster Creek Division, Washington..... | 1,373,200.00 | | 1,373,200.00 | 1,373,200.00 | | | 1,373,200.00 | | |
| Colbran, Colorado..... | 1,070,000.00 | | 1,070,000.00 | 1,070,000.00 | | | 1,070,000.00 | | |
| Colorado-Big Thompson, Colorado..... | 26,032,704.85 | | 26,032,704.85 | 26,032,491.75 | | | 26,032,491.75 | 213.10 | |
| Colorado River, Texas..... | 5,510,500.00 | | 5,510,500.00 | 5,510,500.00 | | | 5,510,500.00 | | |
| Columbia Basin, Washington..... | 87,549,400.06 | | 87,549,400.06 | 87,471,954.62 | | | 87,471,954.62 | 77,445.44 | 198.25 |
| Crescent Lake Dam, Oregon..... | | 320,000.00 | 320,000.00 | | | 312,000.00 | | 8,000.00 | |
| Crooked River, Oregon..... | 2,076,060.00 | | 2,076,060.00 | 2,076,060.00 | | | 2,076,060.00 | | |
| Dalton Gardens, Idaho..... | 258,659.63 | | 258,659.63 | 252,193.13 | | | 252,193.13 | 6,466.50 | |
| Deschutes, Oregon..... | 12,757,159.80 | | 12,757,159.80 | 12,363,945.96 | | | 12,363,945.96 | 393,213.84 | |
| Eden, Wyoming..... | 1,500,000.00 | | 1,500,000.00 | 1,500,000.00 | | | 1,500,000.00 | | |
| Fort Sumner, New Mexico..... | 2,432,166.55 | | 2,432,166.55 | 2,249,754.07 | | | 2,249,754.07 | 182,412.48 | |
| Freightown, Montana..... | 297,282.04 | | 297,282.04 | 215,271.66 | | | 215,271.66 | 82,010.38 | |
| Frutegrowers Dam, Colorado..... | 198,240.71 | | 198,240.71 | 125,450.15 | | | 125,450.15 | 72,790.56 | |
| Gila, Arizona..... | 48,116,167.45 | | 48,116,167.45 | 48,041,945.09 | | | 48,041,945.09 | 74,222.36 | 4,481.92 |
| Grand Valley, Colorado..... | 2,124,314.37 | | 2,124,314.37 | 1,173,184.76 | | 1,828,617.73 | 3,001,802.49 | 996,629.61 | |
| Humboldt, Nevada..... | 1,211,244.68 | 1,874,117.73 | 3,085,362.41 | 644,150.90 | 26,902.68 | 122,998.46 | 794,052.04 | 540,191.10 | |
| Huntley, Montana..... | 1,839,673.68 | 122,998.46 | 1,962,672.14 | 623,778.42 | 88,085.37 | 84,262.50 | 796,126.29 | 1,127,809.89 | |
| Hyrum, Utah..... | 944,046.36 | 84,262.50 | 1,028,308.86 | 617,699.45 | | | 617,699.45 | 617,699.45 | |
| Intake, Montana..... | 46,900.00 | | 46,900.00 | 39,712.00 | | | 39,712.00 | 7,188.00 | |
| Kendrick, Wyoming..... | 600,000.00 | | 600,000.00 | 600,000.00 | | | 600,000.00 | | |

| Location, Oregon, Idaho, Utah, Nevada, & Calif. | 2,500,000.00 | 4,577,000.00 | 10,800,000.00 | 1,577,500.00 | 10,800,000.00 | 4,577,000.00 | 10,800,000.00 | 4,577,000.00 | 10,800,000.00 |
|--|---------------|---------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|
| Lower Yellowstone, Montana-North Dakota | 4,087,893.81 | 4,087,893.81 | 1,104,768.92 | 217,149.83 | 1,321,918.75 | 2,765,975.06 | 1,321,918.75 | 2,765,975.06 | 1,321,918.75 |
| Mancos, Colorado | 900,000.00 | 900,000.00 | 825,000.00 | | 825,000.00 | 75,000.00 | 825,000.00 | 75,000.00 | 825,000.00 |
| Michaud Flats, Idaho | 2,875,000.00 | 2,875,000.00 | 15,740,000.00 | | 15,740,000.00 | | 15,740,000.00 | | 15,740,000.00 |
| Mid Rio Grande, New Mexico | 7,773,242.13 | 8,112,231.13 | 6,225,180.89 | | 6,225,180.89 | | 6,225,180.89 | | 6,225,180.89 |
| Mimodoka, Idaho-Wyoming | 21,796,250.12 | 21,796,250.12 | 4,105,867.90 | 120.37 | 4,105,867.90 | | 4,105,867.90 | | 4,105,867.90 |
| Mirage Flats, Nebraska | 841,917.53 | 841,917.53 | 755,357.53 | | 755,357.53 | | 755,357.53 | | 755,357.53 |
| Missoula Valley, Montana | 45,000.00 | 45,000.00 | 43,312.00 | | 43,312.00 | | 43,312.00 | | 43,312.00 |
| Missouri River Basin | 37,702,624.00 | 37,702,624.00 | 37,701,471.70 | | 37,701,471.70 | | 37,701,471.70 | | 37,701,471.70 |
| Moon Lake, Utah | 1,592,267.76 | 1,592,267.76 | 955,360.66 | | 955,360.66 | | 955,360.66 | | 955,360.66 |
| Newlands, Nevada | 3,257,749.35 | 3,257,749.35 | 355,923.84 | | 355,923.84 | | 355,923.84 | | 355,923.84 |
| Newton, Utah | 350,000.00 | 350,000.00 | 253,750.00 | | 253,750.00 | | 253,750.00 | | 253,750.00 |
| North Platte, Nebraska-Wyoming | 5,938,850.42 | 26,195,024.15 | 3,662,567.28 | | 3,662,567.28 | | 3,662,567.28 | | 3,662,567.28 |
| Ogden River, Utah | 4,734,935.11 | 5,184,935.11 | 3,226,808.76 | | 3,226,808.76 | | 3,226,808.76 | | 3,226,808.76 |
| Okanogan, Washington | 468,597.85 | 594,597.85 | 199,324.23 | | 199,324.23 | | 199,324.23 | | 199,324.23 |
| Oland, California | 2,500,422.05 | 3,292,835.28 | 611,626.81 | | 611,626.81 | | 611,626.81 | | 611,626.81 |
| Owyhee, Oregon-Idaho | 19,826,659.47 | 19,826,659.47 | 16,946,599.04 | | 16,946,599.04 | | 16,946,599.04 | | 16,946,599.04 |
| Palisades, Idaho | 7,301,675.00 | 7,301,675.00 | 7,301,675.00 | | 7,301,675.00 | | 7,301,675.00 | | 7,301,675.00 |
| Palo Verde, California-Arizona | 1,175,000.00 | 1,175,000.00 | 1,139,730.00 | | 1,139,730.00 | | 1,139,730.00 | | 1,139,730.00 |
| Paonia, Colorado | 2,320,000.00 | 2,320,000.00 | 2,320,000.00 | | 2,320,000.00 | | 2,320,000.00 | | 2,320,000.00 |
| Pine River, Colorado | 1,500,000.00 | 1,500,000.00 | 1,099,980.00 | | 1,099,980.00 | | 1,099,980.00 | | 1,099,980.00 |
| Preston Bench, Idaho | 450,300.33 | 450,300.33 | 450,300.33 | | 450,300.33 | | 450,300.33 | | 450,300.33 |
| Provo River, Utah | 32,822,329.54 | 32,822,329.54 | 28,292,024.74 | | 28,292,024.74 | | 28,292,024.74 | | 28,292,024.74 |
| Rapid Valley, South Dakota | 500,000.00 | 500,000.00 | 350,000.00 | | 350,000.00 | | 350,000.00 | | 350,000.00 |
| Rathdrum Prairie, Idaho | 855,909.19 | 855,909.19 | 775,475.31 | | 775,475.31 | | 775,475.31 | | 775,475.31 |
| Rio Grande, New Mexico-Texas | 12,444,123.26 | 12,444,123.26 | 4,196,780.89 | | 4,196,780.89 | | 4,196,780.89 | | 4,196,780.89 |
| Riverton, Wyoming | 7,066,755.05 | 9,566,755.05 | 6,306,676.79 | | 6,306,676.79 | | 6,306,676.79 | | 6,306,676.79 |
| Rogue River, Oregon | 7,075,500.00 | 7,075,500.00 | 7,075,500.00 | | 7,075,500.00 | | 7,075,500.00 | | 7,075,500.00 |
| Salt River, Arizona | 17,482,687.89 | 26,058,182.13 | 4,123,596.85 | | 4,123,596.85 | | 4,123,596.85 | | 4,123,596.85 |
| San Angelo, Texas | 17,184,000.00 | 17,184,000.00 | 17,184,000.00 | | 17,184,000.00 | | 17,184,000.00 | | 17,184,000.00 |
| San Luis Valley, Colorado | 2,520,000.00 | 2,520,000.00 | 2,520,000.00 | | 2,520,000.00 | | 2,520,000.00 | | 2,520,000.00 |
| Sanpete, Utah | 373,375.94 | 373,375.94 | 195,811.97 | | 195,811.97 | | 195,811.97 | | 195,811.97 |
| Santa Maria, California | 13,969,000.00 | 13,969,000.00 | 13,969,000.00 | | 13,969,000.00 | | 13,969,000.00 | | 13,969,000.00 |
| Scofield, Utah | 247,000.00 | 247,000.00 | 151,200.00 | | 151,200.00 | | 151,200.00 | | 151,200.00 |
| Shoshone, Wyoming-Montana | 13,799,165.48 | 14,179,165.48 | 10,878,444.35 | | 10,878,444.35 | | 10,878,444.35 | | 10,878,444.35 |
| Strawberry Valley, Utah | 3,349,423.92 | 3,349,423.92 | 527,375.97 | | 527,375.97 | | 527,375.97 | | 527,375.97 |
| Sun River, Montana | 9,937,347.08 | 10,075,498.12 | 7,921,008.56 | | 7,921,008.56 | | 7,921,008.56 | | 7,921,008.56 |
| Truckee Storage, Nevada | 1,021,603.00 | 1,021,603.00 | 599,660.42 | | 599,660.42 | | 599,660.42 | | 599,660.42 |
| Tumacacuri, New Mexico | 5,901,896.86 | 5,901,896.86 | 5,825,470.45 | | 5,825,470.45 | | 5,825,470.45 | | 5,825,470.45 |
| Umatilla, Oregon | 1,509,722.22 | 1,509,722.22 | 1,014,350.26 | | 1,014,350.26 | | 1,014,350.26 | | 1,014,350.26 |
| Uncompahgre, Colorado | 6,892,511.84 | 6,892,511.84 | 5,503,492.82 | | 5,503,492.82 | | 5,503,492.82 | | 5,503,492.82 |
| Vale, Oregon | 5,022,287.50 | 5,022,287.50 | 4,406,457.74 | | 4,406,457.74 | | 4,406,457.74 | | 4,406,457.74 |
| Ventura River, California | 30,900,000.00 | 30,900,000.00 | 30,900,000.00 | | 30,900,000.00 | | 30,900,000.00 | | 30,900,000.00 |

6,792.26

1,126.92

633.00

1,588.00

1,152.30

636,907.10

2,851,825.51

96,250.00

16,767,420.35

1,508,126.35

2,462.61

51,809.10

35,250.00

400,020.00

1,099,980.00

28,292,024.74

350,000.00

150,000.00

80,433.88

7,354,603.09

760,078.26

14,691,264.42

175,188.97

95,800.00

2,913,756.85

2,822,047.95

2,020,538.52

421,942.58

76,426.41

495,371.96

1,389,019.02

615,829.76

3,073.27

TABLE 9.—*Repayment contracts—matured and unmatured, June 30, 1959—Continued*

| Project and State | Value of repayment contracts | | | Unmatured value of repayment contracts | | | | Matured value of repayment contracts | Amount due and unpaid |
|--|------------------------------|---------------------------------------|------------------|--|---------------------|---------------------------------------|------------------|--------------------------------------|-----------------------|
| | Construction | Rehabilita- tion and betterment | Total | Construction | Deferred charges | Rehabilita- tion and betterment | Total | | |
| PROPERTY TITLED IN UNITED STATES— Continued | | | | | | | | | |
| Vermejo, New Mexico..... | 2, 107, 943.33 | ----- | 2, 107, 943.33 | 2, 107, 943.33 | ----- | ----- | 2, 107, 943.33 | ----- | ----- |
| W. C. Austin, Oklahoma..... | 3, 262, 188.49 | ----- | 3, 262, 188.49 | 2, 526, 655.00 | ----- | ----- | 2, 526, 655.00 | 735, 533.49 | ----- |
| Wapinitia, Oregon..... | 546, 130.00 | ----- | 546, 130.00 | 546, 130.00 | ----- | ----- | 546, 130.00 | ----- | ----- |
| Washita Basin, Oklahoma..... | 23, 991, 500.00 | ----- | 23, 991, 500.00 | 23, 991, 500.00 | ----- | ----- | 23, 991, 500.00 | ----- | ----- |
| Weber Basin, Utah..... | 57, 694, 000.00 | ----- | 57, 694, 000.00 | 57, 694, 000.00 | ----- | ----- | 57, 694, 000.00 | ----- | ----- |
| Weber River, Utah..... | 2, 685, 871.83 | ----- | 2, 685, 871.83 | 617, 350.34 | ----- | ----- | 617, 350.34 | 2, 068, 521.49 | ----- |
| Yakima, Washington..... | 46, 497, 633.59 | 1, 668, 462.47 | 47, 566, 096.06 | 31, 975, 141.54 | 19, 747.89 | 780, 834.86 | 32, 775, 724.29 | 14, 790, 371.77 | 3, 684.46 |
| Yuma, Arizona-California..... | 5, 354, 257.83 | ----- | 5, 354, 257.83 | 123, 559.90 | ----- | ----- | 123, 559.90 | 5, 230, 697.93 | 1, 282.14 |
| Yuma Auxiliary, Arizona..... | 1, 511, 954.40 | ----- | 1, 511, 954.40 | 899, 099.92 | ----- | ----- | 899, 099.92 | 612, 854.48 | 2, 046.08 |
| Subtotal, U. S. title..... | 885, 964, 482.29 | 25, 244, 939.35 | 911, 209, 421.64 | 745, 676, 217.77 | 2, 835, 100.62 | 23, 210, 190.33 | 771, 721, 508.72 | 139, 487, 912.92 | 117, 503.57 |
| PROPERTY TITLED IN WATER USERS | | | | | | | | | |
| Arnold, Oregon..... | ----- | 197, 925.82 | 197, 925.82 | ----- | ----- | 163, 569.21 | 163, 569.21 | 34, 356.61 | ----- |
| Grand Valley, Colorado..... | ----- | 1, 268, 176.49 | 1, 268, 176.49 | ----- | ----- | 594, 283.81 | 594, 283.81 | 673, 892.68 | ----- |
| Grants Pass (S. R. D.), Oregon..... | ----- | 808, 794.56 | 808, 794.56 | ----- | ----- | 785, 294.56 | 785, 294.56 | 23, 500.00 | ----- |
| Palo Verde, Arizona-California..... | ----- | 500, 000.00 | 500, 000.00 | ----- | ----- | 475, 000.00 | 475, 000.00 | 25, 000.00 | ----- |
| Rogue River, Oregon..... | ----- | 1, 991, 000.00 | 1, 991, 000.00 | ----- | ----- | 1, 991, 000.00 | 1, 991, 000.00 | ----- | ----- |
| Umatilla, Oregon..... | ----- | 97, 830.24 | 97, 830.24 | ----- | ----- | 47, 660.84 | 47, 660.84 | 50, 169.40 | ----- |
| Subtotal, water users title..... | ----- | 4, 863, 727.11 | 4, 863, 727.11 | ----- | ----- | 4, 056, 808.42 | 4, 056, 808.42 | 806, 918.69 | ----- |
| Total repayment contracts..... | 885, 964, 482.29 | 30, 108, 666.46 | 916, 073, 148.75 | 745, 676, 217.77 | 2, 835, 100.62 | 27, 266, 998.75 | 775, 778, 317.14 | 140, 294, 831.61 | 117, 503.57 |

¹ \$113, 328.77 collected by September 30, 1959.

Weed Control

The comprehensive weed control program conducted by the Bureau of Reclamation is effectively reducing problems caused by undesirable vegetation and decreasing operation and maintenance costs. It also is aiding materially in reducing water losses resulting from transpiration, evaporation and seepage due to weed growths.

More efficient and economical methods of controlling weeds in ditch banks and channels of irrigation and drainage systems were developed and put into practice through research conducted in cooperation with the Department of Agriculture. This phase of the program is being accomplished at four field stations in the West and the Assistant Commissioner and Chief Engineer's weed control laboratory in Denver. The cooperative research program in the laboratory has been enlarged and now two Bureau of Reclamation and two Department of Agriculture scientists are devoting full time to this work.

The ditchbank seeding program to prevent and control weed growths and erosion was continued with excellent results. The educational program which has been successful in advising project personnel of new and more economical methods for controlling weeds also was continued through the distribution of motion pictures, slide lectures, manuals, special releases on new equipment, and articles in the Reclamation Era.

Work was continued for developing more effective methods for controlling salt cedar (tamarisk) in the Southwest. Progress was made also in controlling other woody phreatophytes where these plants have invaded irrigation systems, natural water courses, reservoirs and other areas. These growths not only usurp millions of acre-feet of water so greatly needed for irrigation and municipal and industrial purposes but also increase flood hazards and take over land which should be used for grazing and agriculture. It is estimated that in the 17 Western States, undesirable phreatophytes use more than 15 million acres and transpire at least 25 million acre-feet of water. Committees composed of representatives of the Departments of Agriculture and Interior, including the Bureau of Reclamation, are working on this and other weed control problems in cooperation with Government agencies.

Much progress has been made in a comparatively short time toward reducing costs and water losses caused by weeds on irrigation systems. It is estimated that in 1959 the losses due to weeds on irrigation systems were reduced \$12 million annually, as compared to 1948. However, all weed problems have not been solved economically as desired. Therefore, research is being continued

as planned to aid in solving this major problem of irrigation systems.

A halogeton control program has been developed in cooperation with other agencies under the provisions of the Halogeton Glomatus Act (Public Law 529, July 14, 1952) in the interest of increasing the land use value of Bureau-administered lands and of protecting the livestock. Surveys to locate halogeton infestations were continued in Utah, Nevada, Colorado, Wyoming, and Idaho, as were the cooperative investigations to determine the most effective and economical control methods. The actual control programs, including chemical spraying and grass seeding, were continued primarily through agreements with the Department's Bureau of Land Management.

Soil and Moisture Conservation

A major objective of the Bureau of Reclamation is the efficient application of water to soil without waste or erosion. The Bureau encourages agricultural agencies and cooperates with them in research or conducts research directed toward water saving methods of irrigation, evaporation control, transpiration losses and seepage control, including canal linings.

The Bureau is interested also in soil and moisture conservation on the lands under its jurisdiction, such as those surrounding reservoirs or other areas withdrawn or acquired for reclamation purposes. This work is done in accordance with Reorganization Plan IV and in fiscal year 1959 covered 108 individual soil and moisture conservation programs on 49 Federal irrigation projects or units.

These operations help protect Reclamation-built facilities from adverse effects of soil erosion. The work undertaken includes watershed reseeding, erosion control structures, and vegetation, pest and dune control measures.

The program objectives are accomplished in cooperation with other Federal agencies, state and local agencies. Water user organizations also assist in planning, and frequently furnish a part of the labor, materials, and funds.

Land Acquisition and Management

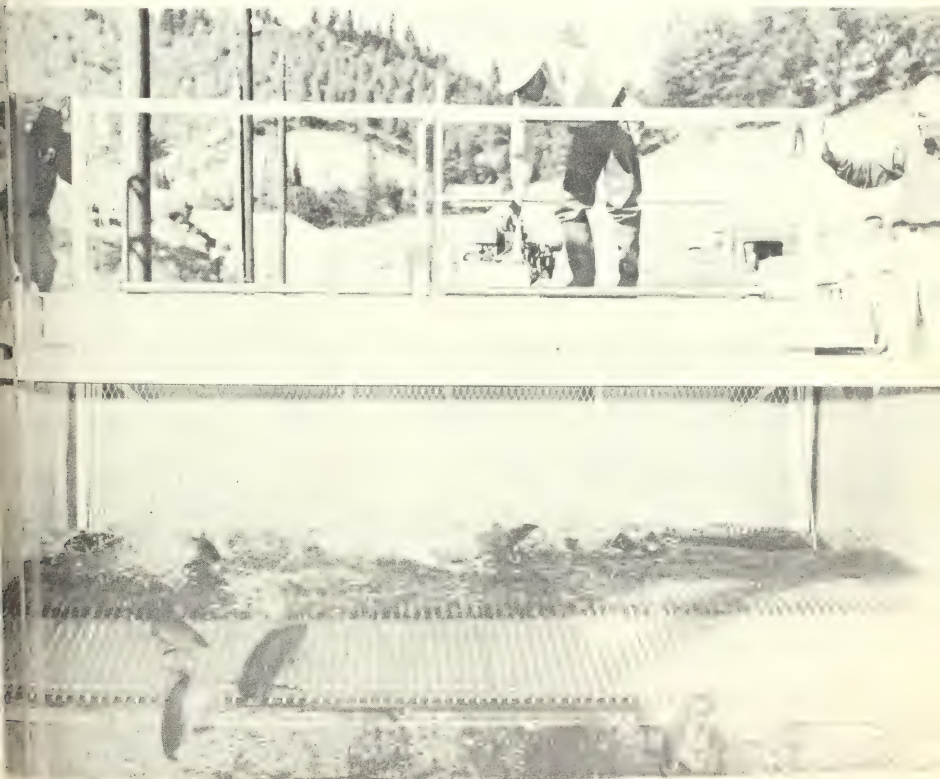
The Bureau followed its policy of restoring or selling lands in excess of its requirements for the control, protection or construction of reclamation facilities. Where lands to be retained were suitable for secondary purposes such as grazing, recreation, or wildlife, they were, wherever possible, turned over to the proper agencies for

ministration. Of the 10 million acres of land under the Bureau's jurisdiction there are now about 7 million acres being administered by the Department's Bureau of Land Management and National Park Service, and State and local organizations.

operation with Other Agencies

The Bureau's activities in planning, developing and operating federal irrigation projects have been greatly facilitated through cooperation with other agencies or organizations. The special skills, experience and equipment of these agencies have been fully utilized whenever it was to the advantage of the Government, in the conservation of our natural resources and its broad application to irrigation and other water uses.

Reclamation reservoir facilities preserve migrating fish.—Measures and facilities to enhance fish and wildlife resources are incorporated in the planning of Bureau of Reclamation water storage projects. Here at the Livingston fish facilities of the Trinity Division of California's Central Valley project, salmon are seen rising from the fish sweep to continue their way to upstream spawning areas.



The cooperative work is implemented by means of agreements between the Bureau and the other organizations involved, which include several agencies within the Department of Agriculture, State Colleges and Extension Services of the 17 Western States, and many other Federal, State and local organizations.

During fiscal year 1959 there were 339 such cooperative agreements in effect. They include studies and investigations conducted on development farms, conservation and efficient use of soil and water, crop and cropping problems, assistance to county, agricultural agents, and weed control studies. They cover also the development and management of reservoir recreational and wildlife areas and assistance in solving many other problems pertaining to development and operation of irrigation projects.

Rehabilitation and Betterment of Existing Projects

To place older projects on a basis comparable to projects being constructed so far as conservation of water, efficiency of operation, and adequacy of drainage are concerned, it is necessary for the facilities to be rehabilitated and improved. In some instances these improvements cannot be accomplished by an annual operation and maintenance program that is within the water users' ability to finance on a current basis; they can be accomplished only by a rehabilitation and betterment program that is within their ability to pay over an extended period. In these instances contracts are entered into, prior to start of construction, with the irrigation districts concerned for the repayment of the total cost of the work. The annual rate of repayment by the water users is based on their ability to pay, after giving due consideration to other outstanding repayment obligations.

Accomplishments this year emphasized the increased irrigation efficiency and the conservation of water made possible through canal lining, improved irrigation structures, and improved drainage.

During the year rehabilitation and betterment work was in progress on 13 projects as follows:

Bitter Root project, Montana.—Flume and siphon rehabilitation and repair work on the main canal.

Boise project, Idaho.—Repairing and strengthening the New York Canal which serves the Arrowrock Division.

Grand Valley project, Colorado.—Rehabilitation and repair of the Grand Valley Diversion Dam and appurtenant works.

North Platte project, Nebraska and Wyoming.—Rehabilitation of Pathfinder Dam north tunnel outlet works, installation of 7.8 miles

membrane lining, and 2.5 miles of concrete irrigation pipe on the lateral system.

Ogden River project, Utah.—Rehabilitation and betterment of the distribution facilities.

Okanogan project, Washington.—Protective riprap placed at higher levels on the upstream face of Conconully Dam, and the out-works tunnel and spillway rehabilitated.

Orland project, California.—Urgently needed canal relining.

Owyhee project, Idaho and Oregon.—Rehabilitation and betterment of pumping plants and the Succor Creek Diversion Dam and installation of water measuring devices in canals and laterals.

Riverton project, Wyoming.—Placement of asphaltic membrane lining of the pilot canal and laterals and the Wyoming laterals (Second Division). Also drainage construction.

Rogue River Basin project, Oregon.—Rehabilitation of Medford Irrigation District and the Rogue River Valley Irrigation District distribution systems and the Medford Canal. The work includes placement of concrete lining; replacing bridges, farm turnouts, ditches, and other small structures; installing concrete pipe and relining canal banks.

Salt River project, Arizona.—Lining on one or both banks of main drains at critical locations with approximately 400,000 square feet of reinforced, pneumatically applied mortar and unreinforced concrete; constructing three additional canal structures; lining approximately 24 miles of laterals and replacing approximately 10 miles of old laterals with underground concrete pipe lines and rehabilitating additional lateral structures.

San River project, Montana.—Started on rehabilitation and betterment of canals and laterals under a performance contract with the Shaw Irrigation District.

Yakima project, Washington.—Continued work on main drains of the Sunnyside Division.

Development Farms

Development farms have proved to be an important part of the settlement program on new areas being developed for irrigation. The Bureau's field-scale demonstrations and the research conducted by cooperating agricultural agencies on these farms furnish much valuable information for the use of the new settlers, and remove many of the factors which caused hardships and often failures of settlers on earlier developed projects. They also aid in the conservation of soil and water through promoting more efficient use of these important natural resources.

Development farms are established as far as possible in advance of settlement, usually 2 to 5 years, in order that much of the necessary experience and information will have been obtained when new settlers arrive. The farms are located in areas which best represent the soils and other conditions of the new project.

The major portion of each farm is devoted to field-scale demonstrations of approved farm irrigation systems, irrigation methods, kinds and varieties of adapted crops, cultural practices, weed control, farm drainage and solutions to other problems with which irrigation farmers are faced. From 10 to 25 percent of most of the farms is set aside for research, which is conducted by State College Experiment Stations and cooperating agricultural agencies. The research may include investigations regarding fertilizer requirements, handling of problem soils, water requirements, plant diseases, insect pests, and other problems peculiar to a particular area. Farming methods developed from research and thoroughly tested are demonstrated on the farms. Some farms also have aided in determining feasibility of projects. Farms not operated by the owners are leased to carefully selected, experienced farmers as soon as the land is cleared and leveled and the necessary buildings constructed. This method of operation has resulted in the farms becoming self-supporting.

Eleven development farms were in operation during the year 1917. Farms previously operated have served their purpose and were discontinued. Operating farms are located in the Wellton-Mohave Division of the Gila project, Arizona, and in several units of the Missouri River Basin project. Additional farms are proposed for new areas scheduled for development.

The Bureau of Reclamation and other agencies responsible for the development farms work closely with the State College Extension Services to be certain that the information from research findings and demonstrations is properly disseminated to the new settlers. Hundreds of farmers attend the annual field days and tours at which representatives of the Bureau and the cooperating agencies explain the work in detail. Project settlers are encouraged to visit the farms at any time to obtain information. Information pamphlets are prepared and distributed. The development farms benefit college and high school students who visit the farms with their instructors.

Land Settlement

The Bureau conducted one land opening on the Columbia River project, making available for settlement 31 farm units embracing

223 irrigable acres of new land in the South-Columbia and Quincy-Columbia Basin irrigation districts.

Since the close of World War II, 62 land openings have been held for 14 Reclamation projects. A total of 2,756 new farm units, encompassing 263,856 irrigable acres of public land, have been made available for selection by qualified applicants.

Availability of additional new farm units is anticipated next fiscal year on the Columbia Basin project in Washington and on the Minidoka project in Idaho. Contingent on final determination of land requirements along the Gila River, in connection with flood control studies being conducted by the U.S. Army Corps of Engineers, a few additional units may become available from time to time on the Minidoka project in Arizona.

Additional privately owned lands in the Central Valley, Columbia Basin, and Missouri River Basin projects will be supplied with irrigation water. A considerable amount of this privately owned land may be available for sale by the owners.

Hydroelectric Power Development

In order to utilize to the greatest advantage the water supplies made available by multipurpose reservoirs, the Bureau of Reclamation has constructed and, as of June 30, 1959, operated 41 powerplants with an installed nameplate capacity of 5,137,550 kilowatts. In addition, the Bureau is responsible for marketing the power generated at four powerplants constructed by the U.S. Army Corps of Engineers with a total installed nameplate capacity of 745,000 kilowatts and one powerplant installed by the International Boundary and Water Commission, with a total nameplate capacity of 31,500 kilowatts.

Sale of electric power by the Bureau during the year aggregated 254,260,413 kilowatt hours, with revenues from sales totaling \$70,900,12, as shown in table 10.

Fiscal Year Expansion

During the year the installed nameplate capacity of hydroelectric powerplants at Bureau multipurpose projects, and at projects for which the Bureau markets power, was increased 45,450 kilowatts. The 1,400 kilowatt Lingle hydroelectric powerplant was retired. This resulted in a net increase of 44,050 kilowatts in installed nameplate capacity over last year.



Power for western industrial expansion.—Hydroelectric power from Bureau of Reclamation projects plays a major role in the great postwar population and industrial expansion of the West. Revenues from power sales also are a major element in repayment of project construction costs. This workman is dwarfed by the huge bushings on the 230-kilovolt oil circuit breakers in the switchyard at the Hungry Horse powerplant in Montana.

TABLE 10.—Bureau of Reclamation power systems, power sales, and revenues by projects, fiscal year ending June 30, 1959

| Projects | Sales of electric energy, kilowatt-hours ¹ | Revenues from sales ¹ |
|---|---|----------------------------------|
| ..... | 119, 171, 215 | \$299, 466. 48 |
| lder Canyon..... | 4, 104, 549, 853 | 9, 885, 374. 15 |
| tral Valley..... | 2, 971, 395, 218 | 11, 799, 215. 17 |
| umbia Basin ² | 10, 794, 542, 000 | 12, 912, 684. 20 |
| itna..... | 159, 437, 228 | 1, 633, 407. 32 |
| on..... | 166, 058, 300 | 470, 502. 50 |
| Peck..... | 210, 510, 189 | 1, 000, 305. 80 |
| ry Horse ² | 1, 014, 791, 100 | 3, 822, 705. 42 |
| doka..... | 167, 776, 240 | 792, 365. 65 |
| ouri River Basin: Eastern Division..... | 3, 346, 540, 590 | 12, 336, 480. 70 |
| ouri River Basin: Western Division ² | 1, 195, 352, 695 | 7, 295, 028. 94 |
| h Platte..... | 120, 043, 339 | 767, 076. 14 |
| hades..... | 512, 068, 029 | 1, 609, 016. 88 |
| er-Davis..... | 1, 367, 152, 329 | 5, 439, 354. 67 |
| o River Basin..... | 15, 806, 647 | 47, 931. 26 |
| grande..... | 86, 871, 397 | 431, 553. 32 |
| er Basin..... | 6, 329, 826 | 21, 577. 22 |
| kna ² | 135, 498, 231 | 374, 076. 55 |
| n..... | 10, 365, 987 | 30, 289. 65 |
| Grand total..... | 26, 504, 260, 413 | 70, 968, 412. 02 |

¹ Does not include energy sales and revenues in transactions between Bureau projects.
² Deliveries to and revenues from Bonneville Power Administration included as follows:

| | Kilowatt-hours | |
|---------------------|-------------------|--------------------|
| Columbia Basin..... | 10, 194, 033, 586 | \$12, 612, 430. 00 |
| Hungry Horse..... | 1, 012, 277, 000 | 3, 816, 000. 00 |
| Yakima..... | 118, 155, 644 | 326, 000. 00 |
| Total..... | 11, 324, 466, 230 | 16, 754, 430. 00 |

Includes systems of Riverton, Shoshone, Colorado-Big Thompson, and Kendrick projects.

Hydroelectric powerplants which are now an additional source of energy as a result of water conservation works had the following nameplate capacity installed during the year:

| | Kilowatts |
|---|-----------|
| Colorado-Big Thompson project, Big Thompson powerplant..... | 4,500 |
| Missouri River Basin project, Glendo powerplant..... | 24,000 |
| Fort Basin project, Gateway powerplant..... | 4,275 |
| Fort Basin project, Wanship powerplant..... | 1,425 |
| Yakima project, Roza division, Roza powerplant..... | 11,250 |

Additional Capacity Under Construction

At the end of fiscal year 1959, the Bureau of Reclamation had under construction 6 powerplants, which will have an ultimate installed nameplate capacity of 1,085,500 kilowatts:

| Plant | Project | River | State | Nameplate capacity (kw.) |
|-----------------------|-----------------------------|---------------------|---------------|--------------------------|
| Upper Molina..... | Collbran..... | Colorado..... | Colorado..... | 8, 640 |
| Lower Molina..... | do..... | do..... | do..... | 4, 860 |
| Glendon..... | Colorado River Storage..... | do..... | Arizona..... | 900, 000 |
| Flaming Gorge..... | do..... | Green..... | Utah..... | 108, 000 |
| Frederick Canyon..... | Missouri River Basin..... | North Platte..... | Wyoming..... | 48, 000 |
| Grand Coulee..... | Rogue River Basin..... | Emigrant Creek..... | Oregon..... | 16, 000 |

The Corps of Engineers is proceeding with the construction of its plants in the Missouri River Basin project. The ultimate installed

nameplate capacity of Oahe Powerplant in South Dakota will 595,000 kilowatts. The Bureau of Reclamation will be the marketing agent for energy generated by this plant, as is the case for other Corps plants on the Missouri River Basin project.

Hydroelectric Powerplants

The hydroelectric powerplants constructed and operated, under construction and authorized to be constructed by the Bureau of Reclamation and powerplants for which the Bureau is the marketing agent are listed in table 11.

TABLE 11.—*Hydroelectric powerplants*

A. CONSTRUCTED AND OPERATED BY BUREAU OF RECLAMATION

| State | Project | Name of plant | Calendar year of initial operation | Nameplate rating | |
|------------------------|----------------------------|---------------------------------|------------------------------------|----------------------|----------------------|
| | | | | Existing (kilowatts) | Ultimate (kilowatts) |
| 1. Alaska..... | Eklutna..... | Eklutna..... | 1955 | 30,000 | 30,000 |
| 2. Alaska..... | do..... | Old Eklutna ¹ | | 2,000 | 0 |
| 3. Arizona-Nevada..... | Boulder Canyon..... | Hoover ² | 1936 | 1,249,800 | 1,249,800 |
| 4. Arizona..... | Parker-Davis..... | Davis..... | 1951 | 225,000 | 225,000 |
| 5. California..... | do..... | Parker..... | 1942 | 120,000 | 120,000 |
| 6. California..... | Central Valley..... | Folsom..... | 1955 | 162,000 | 162,000 |
| 7. California..... | do..... | Keswick..... | 1949 | 75,000 | 75,000 |
| 8. California..... | do..... | Nimbus..... | 1955 | 13,500 | 13,500 |
| 9. California..... | do..... | Shasta..... | 1944 | 379,000 | 379,000 |
| 10. California..... | Yuma..... | Siphon Drop..... | 1926 | 1,600 | 1,600 |
| 11. Colorado..... | Colorado-Big Thompson..... | Big Thompson..... | 1959 | 4,500 | 4,500 |
| 12. Colorado..... | do..... | Estes..... | 1950 | 45,000 | 45,000 |
| 13. Colorado..... | do..... | Flatiron..... | 1954 | 71,500 | 71,500 |
| 14. Colorado..... | do..... | Green Mountain..... | 1943 | 21,600 | 21,600 |
| 15. Colorado..... | do..... | Marys Lake..... | 1951 | 8,100 | 8,100 |
| 16. Colorado..... | do..... | Polehill..... | 1954 | 33,250 | 33,250 |
| 17. Colorado..... | Grand Valley..... | Grand Valley ³ | 1933 | 3,000 | 3,000 |
| 18. Idaho..... | Boise..... | Anderson Ranch..... | 1950 | 27,000 | 27,000 |
| 19. Idaho..... | do..... | Black Canyon..... | 1925 | 8,000 | 8,000 |
| 20. Idaho..... | do..... | Boise Diversion..... | 1912 | 1,500 | 1,500 |
| 21. Idaho..... | Minidoka..... | Minidoka..... | 1909 | 13,400 | 13,400 |
| 22. Idaho..... | Palisades..... | Palisades..... | 1957 | 114,000 | 114,000 |
| 23. Montana..... | Missouri River Basin..... | Canyon Ferry..... | 1953 | 50,000 | 50,000 |
| 24. Montana..... | Hungry Horse..... | Hungry Horse..... | 1952 | 285,000 | 285,000 |
| 25. New Mexico..... | Rio Grande..... | Elephant Butte..... | 1940 | 24,300 | 24,300 |
| 26. South Dakota..... | Missouri River Basin..... | Angostura..... | 1951 | 1,200 | 1,200 |
| 27. Utah..... | Provo River..... | Deer Creek..... | 1958 | 4,950 | 4,950 |
| 28. Utah..... | Weber Basin..... | Gateway..... | 1958 | 4,275 | 4,275 |
| 29. Utah..... | do..... | Wanship..... | 1958 | 1,425 | 1,425 |
| 30. Washington..... | Columbia Basin..... | Grand Coulee..... | 1941 | 1,974,000 | 1,974,000 |
| 31. Washington..... | Yakima..... | Chandler..... | 1956 | 12,000 | 12,000 |
| 32. Washington..... | do..... | Roza..... | 1958 | 11,250 | 11,250 |
| 33. Wyoming..... | Missouri River Basin..... | Glendo..... | 1958 | 24,000 | 24,000 |
| 34. Wyoming..... | Kendrick..... | Aleova..... | 1955 | 36,000 | 36,000 |
| 35. Wyoming..... | do..... | Seminole..... | 1939 | 32,400 | 32,400 |
| 36. Wyoming..... | Missouri River Basin..... | Boysen..... | 1952 | 15,000 | 15,000 |
| 37. Wyoming..... | do..... | Kortes..... | 1950 | 36,000 | 36,000 |
| 38. Wyoming..... | North Platte..... | Guernsey..... | 1927 | 4,800 | 4,800 |
| 39. Wyoming..... | Riverton..... | Pilot Butte..... | 1925 | 1,600 | 1,600 |
| 40. Wyoming..... | Shoshone..... | Heart Mountain..... | 1948 | 5,000 | 5,000 |
| 41. Wyoming..... | do..... | Shoshone..... | 1922 | 5,600 | 5,600 |
| Subtotal A..... | | | | 5,137,550 | 5,137,550 |

¹ Acquired from City of Anchorage on completion of Eklutna project fiscal year 1955. This plant is not being operated and has been declared surplus.

² Power plant units operated by Southern California Edison Co. and city of Los Angeles, Department of Water and Power as agents of the United States.

³ Leased to Public Service Co. of Colorado for operation.

U. S. C. E.—United States Corps of Engineers

I. B. W. C.—International Boundary and Water Commission

TABLE 11.—*Hydroelectric powerplants—Continued*

CONSTRUCTED AND OPERATED BY OTHERS—POWER MARKETED BY U. S. B. R.

| State | Project | Name of plant | Calendar year of initial operation | Nameplate rating | |
|-------------------|-----------------------------|-------------------|------------------------------------|----------------------|----------------------|
| | | | | Existing (kilowatts) | Ultimate (kilowatts) |
| Montana..... | Missouri River Basin (USCE) | Fort Peck..... | 1943 | 85,000 | 165,000 |
| North Dakota..... | do..... | Garrison..... | 1956 | 240,000 | 400,000 |
| South Dakota..... | do..... | Fort Randall..... | 1954 | 320,000 | 320,000 |
| South Dakota..... | do..... | Gavins Point..... | 1956 | 100,000 | 100,000 |
| Texas..... | Falcon (IBWC)..... | Falcon..... | 1954 | 31,500 | 42,000 |
| Subtotal B..... | ..... | ..... | ..... | 776,500 | 1,027,000 |

C. UNDER CONSTRUCTION BY BUREAU OF RECLAMATION

| | | | | | |
|-----------------|---------------------------|---------------------|-------|-------|-----------|
| Arizona..... | Colorado River Storage | Glen Canyon..... | 1964 | ..... | 900,000 |
| Colorado..... | Collbran..... | Upper Molina..... | 1961 | ..... | 8,640 |
| Colorado..... | do..... | Lower Molina..... | 1961 | ..... | 4,860 |
| Oregon..... | Rogue River Basin..... | Green Springs..... | 1959 | ..... | 16,000 |
| Utah..... | Colorado River Storage | Flaming Forge..... | 1963 | ..... | 108,000 |
| Wyoming..... | Missouri River Basin..... | Fremont Canyon..... | 1960 | ..... | 48,000 |
| Subtotal C..... | ..... | ..... | ..... | ..... | 1,085,500 |

UNDER CONSTRUCTION BY OTHERS—POWER TO BE MARKETED BY U. S. B. R.

| | | | | | |
|-------------------|-----------------------------|-----------|-------|-------|---------|
| South Dakota..... | Missouri River Basin (USCE) | Oahe..... | 1962 | ..... | 595,000 |
| Subtotal D..... | ..... | ..... | ..... | ..... | 595,000 |

Transmission System

To provide electrical energy for Bureau projects and to market surplus to its needs, a transmission system including powerhouses, substations, switchyards, and transmission lines, has been constructed. During the year, approximately 76 circuit miles of transmission lines were completed, resulting in a total system of 9,992 circuit miles of line. As of June 30, the installed transformer capacity of the individual substations operated by the Bureau was 11,145,000 kilovolt-amperes.

The transmission lines completed in fiscal year 1959 are shown in Table 12.

TABLE 12.—*Transmission lines completed during fiscal year 1959*

| Project and line | Voltage (kilovolts) | In-service date | Circuit miles |
|---|---------------------|---------------------|---------------|
| Reclamation project: Eklutna Powerplant to Palmer ¹ | 115 | September 1958..... | 9.00 |
| Reclamation project: Grey Powerplant to Utah Power & Light Co. line..... | 44 | December 1958..... | .02 |
| Reclamation project: Washup Powerplant to Utah Power & Light Co. line..... | 44 | August 1958..... | .30 |
| Reclamation project: Missouri River Basin project: Utica Junction to Sioux Falls..... | 230 | March 1959..... | 66.84 |

¹Reclamation of 6 mile section from Eklutna Powerplant to Matanuska. Total length of line from Eklutna Powerplant to Palmer substation is now 12.5 miles.

During the year, 90 contracts were executed for sale of power transmission service, or for other purposes, as follows:

| <i>Number of contracts:</i> | <i>Types of customer</i> |
|-----------------------------|------------------------------|
| 24----- | Private utilities |
| 27----- | REA cooperatives |
| 22----- | Municipalities |
| 7----- | Federal agencies |
| 5----- | State agencies |
| 1----- | Irrigation district |
| 4----- | Miscellaneous type contracts |

A number of the contracts executed were renewals of operating contracts or revisions of existing contracts resulting from changes in operating conditions.

The Bureau continued its policy of contracting whenever possible with private utilities, public bodies and cooperatives for wheeling power and energy over existing facilities. The Bureau also entered into several interchange agreements with its customers.

Customers served by Reclamation during fiscal year 1959 are summarized in table 13.

The Bureau at year's end had 85 contracts under active negotiation. In this number are included 18 contracts with private utilities, 20 with REA Cooperatives, 33 with municipalities, 3 with other Federal agencies, 3 with State Authorities, 1 with an irrigation district and 1 miscellaneous type contract. A number of these are to renew existing contracts or to revise contracts in existence because of changes in operating conditions.

TABLE 13.—*Summary by classification of customers for 12 months ending June 30, 1959*¹

| | Number of customers | Sales of electric energy, kilowatt-hours | Revenue from sales |
|--|---------------------|--|--------------------|
| Privately owned utilities..... | 33 | 3,828,647,673 | \$12,727,403 |
| Municipal utilities..... | 106 | 1,995,252,318 | 7,824,442 |
| State Government utilities..... | 13 | 4,154,294,063 | 14,500,600 |
| Cooperative utilities (Rural Electrification Administration projects)..... | 84 | 2,220,150,854 | 11,477,620 |
| Other Federal utilities ² | 6 | 11,396,866,713 | 17,060,580 |
| Residential and domestic..... | 320 | 6,040,922 | 3,401,000 |
| Rural (other than Rural Electrification Administration projects)..... | 7 | 176,380 | 1,160,000 |
| Commercial and industrial..... | 19 | 98,753,695 | 500,000 |
| Public authorities..... | 83 | 1,799,751,090 | 5,550,000 |
| Interdepartmental..... | 44 | 1,004,326,705 | 1,280,000 |
| Total all customers..... | 715 | 26,504,260,413 | 70,960,000 |

¹ Does not include energy sales and revenues in transactions between Bureau projects.

² Totals include 11,324,466,230 kilowatt-hours delivered to Bonneville Power Administration for marketing and \$16,754,430.00 in payments by that agency.

Project Development

The project development program involves preparation of comprehensive plans for development of river basin resources and the investigation and planning of potential projects to meet the requirements of the fast-growing population of the West for optimum utilization and conservation of its limited water resources. The program also includes detailed preconstruction studies on newly authorized projects.

Comprehensive Basin Surveys

During the year, the Bureau, in cooperation with other agencies, was engaged in comprehensive surveys in 10 river basins throughout the West. In addition, comprehensive studies were active in 12 subbasins of the Missouri River Basin project. Miscellaneous general studies were essentially completed in many of these subbasins such as the South Dakota Pumping Division, the Three Forks Division in Montana and the White Division in South Dakota and Nebraska.

Project Planning Reports

By the end of the year project planning reports had been submitted to Congress on Vale project, Bully Creek Extension, Oregon; Venita project, Cheney Division, Kansas; Gray Reef Dam and Reservoir, Glendo Unit, Missouri River Basin project, Wyoming; and La Feria Division, Lower Rio Grande Rehabilitation project, Texas. Processing of the Secretary's certification and accompanying economic justification report on the Curecanti Unit, Colorado River Bridge project, Colorado, was essentially completed. Assistance was also rendered to the Bureau of the Budget for reports submitted previously on the Garrison Diversion Unit of the Missouri River Basin project and on the coordinated report of the Bureau of Reclamation and the Department of the Interior's Bureau of Indian Affairs on the San Juan-Chama and Navajo Irrigation projects. A planning report on Mann Creek project, Idaho, was transmitted to interested States and Federal agencies for review prior to submission to the Bureau of the Budget.

Definite Plans

During the fiscal year definite plans for authorized projects were completed on the Mercedes Division, Lower Rio Grande Rehabilita-

tion project, Texas; the Fort Cobb Division, Washita Basin project, Oklahoma, Volume I; the Cedar Bluff Unit, Missouri River Basin project, Kansas; the Crooked River project, Oregon; and on the Hammond project, New Mexico, the Smith Fork project, Colorado, and the Seedskaadee project, Wyoming, all participating projects of the Colorado River Storage project.

Alaska

Investigations continued under the permanently authorized investigations program of the Bureau in Alaska. A planning report on the Snettisham project was essentially completed.

Loan Program

Congress appropriated \$14,497,000 for six loans under the Small Reclamation Projects Act of 1956. Construction was initiated on four of these during the year. These are the first projects to be started under the provisions of this act. Repayment contracts were executed for the other two and funds are available for use when the contracts are validated by the courts. Five other small project applications were approved and forwarded to the Congress, while three more were approved by the Secretary but had not yet been forwarded to Congress by June 30. These last eight approved applications represent loans totaling \$16,032,000. Additional applications were received and are under consideration.

Three distribution system loan applications (Public Law 130 3d Cong.) were approved. On one of these, however, the local voters did not approve the repayment contract. The other two completed all requirements including the required local approvals. The repayment contracts are ready for execution on behalf of the United States when funds become available.

River Compacts

The act granting the consent of Congress to the negotiations of the Niobrara River Compact by the States of Nebraska, Wyoming and South Dakota, approved August 5, 1953, was amended by extending the time for such negotiations from 5 years to 8 years.

A bill was introduced granting the consent of Congress to the States of Kansas and Nebraska to negotiate and enter into a compact

ating to the apportionment of the waters of the Big Blue River and its tributaries as they affect such States.

The Bureau rendered technical assistance in inter-State compact negotiations between California and Nevada on the Lahontan Basin.

Hydrology

The Hydrology Branch continued its study of hydrologic problems associated with operating and proposed Reclamation projects. On all multiple-purpose reservoirs and coordinated systems, studies were made to develop operational criteria to attain optimum benefits on the standpoint of irrigation, flood control, hydropower, recreation, fish and wildlife resources, and sediment control.

Channelization investigations were conducted on the James, Middle Rio Grande, and Lower Colorado Rivers. Water salvage is a major part of the Pecos, Middle Gila, Middle Rio Grande and Lower Colorado plans.

Cooperative work with the Department's Geological Survey was continued on the measurement of water use by salt cedars in the Salt River Valley of Arizona. Contacts with various Federal, State, and local agencies were maintained on a program to determine the extent of phreatophyte infestation and growth habits, and its nonbeneficial presumptive use of water.

A basinwide hydrometeorological study of probable storms for aid in spillway design for the Central Utah project area was prepared. A similar basinwide study was initiated for the eastern slopes of the Sierra Nevadas.

Cooperative investigations of the effects of land treatment and conservation practices on yield of stream flow were conducted with the Agricultural Research Service and Soil Conservation Service.

International Streams Investigations

The Bureau of Reclamation is represented on two International Engineering Boards of the International Joint Commission. The Souris-Red Rivers Engineering Board continued the systematic collection and study of hydrologic data and related flood control and irrigation investigations in the Souris, Red, and Missouri River basins. The Board also assisted the Commission, as requested, in connection with engineering aspects of the interim measures for apportionment of the waters of the Souris River between the United States and Canada. During the year the Waterton-Belly Rivers Engineering Board was inactive.

Contracts and Property Management

Reclamation purchases of equipment, supplies and services totaled \$14,400,000 during the year. Of the purchases from commercial sources (\$11,300,000), nearly one-half (\$5,200,000) were from small business firms. Four hundred and fifty-four construction contract awards totaled \$66,500,000. Of this amount, \$63,500,000 represented 242 major construction contracts; the balance consisted of relocation contracts and minor construction work.

Several changes were made in contract provisions aimed at eliminating contractor claims, litigation, and misunderstandings. A procedure was adopted of providing railroads with a uniform type of liability insurance protection where Bureau construction crosses or invades railroad property. An increase from \$500 to \$2,500 in the per contract market purchase limitation, pursuant to Public Law 85-800, was authorized for field offices, resulting in improved efficiency and simplification. New simplified contract forms were adopted for minor construction contracts under \$10,000. Procedures were established for applying the Small Business Act and the Buy American Act to construction contracts. Division personnel were active on several inter-agency committees under General Services Administration sponsorship dealing with contracting and procurement problems. The major portion of the Bureau's Reclamation Instructions covering contracting and procurement was completed during the year.

Real property inventory data covering approximately 9,500,000 acres of land, 3,800 houses and other miscellaneous buildings, structures, and facilities valued at approximately \$2,670,000,000 were converted to a punchcard system for automatic data processing, to facilitate internal reporting, control, and management.

Real property with an acquisition cost of \$791,000 was disposed of during the year. Of this total, property with an acquisition cost of \$644,000 was returned to the tax rolls through sales to the general public.

Disposal of personal property with an acquisition cost of \$1,130,000 was accomplished during the year.

The Bureau prohibited use of carbon tetrachloride fire extinguishers in motorized equipment and buildings, eliminating danger to fire fighting personnel.

Revised Reclamation Instructions on Property Management have been completed for printing and issuance. It is contemplated that operating efficiencies will result.

Use of the National Credit Card for service station purchase of petroleum and other products was studied and adopted on a Bureau-wide integrated basis.

A study of storehouse facilities, staffing and work load was initiated for the purpose of improving efficiency and economy. Studies on the storage, retention and disposition of some 136,000 cubic feet of drill cuttings was initiated.

Initial steps were taken toward increased utilization of Department of Defense excess personal property.

Program Coordination and Finance

Systems were improved to enable quick compilations of annual and long-range fund requirements on new Bureau projects being considered by the Department, the Congress, or others for early construction. The objective of the compilations is to illustrate directly the effect proposed new starts have on the Bureau's annual appropriation requirements in the future.

Procedures to provide information on significant changes which have occurred in budget data from similar data previously presented to the Congress were clarified and improved.

Existing program control procedures continued to be effective and sufficiently sensitive. A number of fund adjustments were accomplished during the fiscal year which improved overall Bureau performance.

Construction schedule procedures were revised to develop more logical and better scheduling of construction service facilities.

Finance

Regional office committees were given permanent status and will review on a continuing basis the application of automatic and electronic data processing methods to accounting and other administrative operations of the Bureau. An Electronic Data Processing Section was established in the Office of the Assistant Commissioner and Chief Engineer, Denver, Colo., to coordinate all phases of the Bureau's data processing program. One regional office and the Columbia Basin project office were authorized to lease punchcard equipment and small electronic computers. Such accounting operations as payroll, labor cost distribution, clearing accounts, allotment, distribution, plant and general ledgers will be processed on the installations. The small electronic computers will be used primarily for engineering computations.

A systems study of administrative applications is being performed in the Denver Office to determine the feasibility of and benefits to be derived from electronic computer processing. Selected field financial personnel participated in a Financial Management Institute in Washington, D.C., sponsored by the U.S. Civil Service Commission.

Budget

Appropriations made available to the Bureau of Reclamation for all purposes in fiscal 1959 totaled \$265,814,535. This amount includes \$10,237,200 appropriated in two supplemental appropriations, primarily for loans to local organizations for the construction of projects authorized under the Small Reclamation Projects Act of 1956 (Public Law 984). Also included was a small amount to cover pay raise costs. Permanent appropriations are not included. Appropriations for 1959 exceeded the funds made available in 1958 by \$5 millions. This increase was due primarily to normal acceleration of the program of the Colorado River Storage project and an increase in the fund requirements for the loan program.

With an unobligated balance of \$10.1 millions carried over from fiscal year 1958 for construction, investigations and the loan program, plus funds advanced by water users, trust funds, the continuing fund for emergency expenses, Fort Peck project and new appropriations, the total amount available to Reclamation was \$283.5 millions. Of this amount there remained unobligated at the close of 1959 for construction, investigations and the loan program, funds in the amount of \$17.7 millions. These funds are available in fiscal year 1960.

Obligations for 1959 totaled \$262.9, or 93 percent of the amount programmed as compared to 96 percent of the program accomplished in 1958.

A new item was added to the Bureau's appropriation structure in 1959. For the first time funds were appropriated under the heading "Loan Program" to implement provisions of Public Laws 98-130 of the 84th Congress, which authorized loans to local organizations for the construction of small irrigation projects and new distribution systems on existing Reclamation projects, respectively. Therefore funds were made available for the Loan Program under construction and Rehabilitation."

Funds appropriated, by activity, for fiscal 1959, together with amounts to be derived from the special and general funds are shown in table 14:

TABLE 14. *Condensed statement of appropriations, fiscal year 1959 exclusive of trust funds and permanent appropriations*

| | | |
|---------------------------------|-------------|-------------|
| General Investigations | | \$4,556,000 |
| Reclamation Fund | \$3,831,000 | |
| Colorado River Development Fund | 500,000 | |
| General Fund | 225,000 | |
| Construction and Rehabilitation | | 146,015,000 |
| Reclamation Fund | 85,000,000 | |
| General Fund | 61,015,000 | |
| Colorado River Basin Fund | | 68,033,335 |
| General Fund | 68,033,335 | |
| Operation and Maintenance | | 28,331,600 |
| Reclamation Fund | 23,083,483 | |
| Colorado River Dam Fund | 2,078,900 | |
| General Fund | 3,169,217 | |
| Water Conservation Program | | 14,497,000 |
| General Fund | 14,497,000 | |
| General Administrative Expenses | | 4,381,600 |
| Reclamation Fund | 4,381,600 | |
| Grand total | 265,814,535 | 265,814,535 |
| Reclamation Fund | | 116,296,083 |
| Colorado River Dam Fund | | 2,078,900 |
| Colorado River Development Fund | | 500,000 |
| General Fund | | 146,939,552 |
| | | 265,814,535 |

TABLE 15.—*The reclamation fund, fiscal years 1958–60, funds available for appropriation*

| Receipts and appropriations | Actual 1958 | Actual 1959 | Estimated 1960 |
|---|----------------|----------------|-------------------|
| Unappropriated balance brought forward (as of June 30) | \$98,805,061 | \$125,985,130 | \$130,388,611 |
| Receipts and collections: | | | |
| Bureau of reclamation and other agencies, 0.100 | 13,198,431 | 15,392,766 | 16,439,000 |
| Other agencies, 0.200 | 46,972,771 | 46,517,273 | 53,678,800 |
| Water revenues, 0.300 | 52,192,719 | 58,475,183 | 54,621,000 |
| Total, accretions and collections | 112,363,921 | 120,385,222 | 124,738,800 |
| Unexpended and lapsed appropriations | 1,878,002 | 415,547 | |
| Total available for appropriation | 213,046,984 | 246,785,899 | 255,127,411 |
| Permanently authorized appropriations for: | | | |
| Fund of revenue collections | | 100,000 | 125,000 |
| Pawnee Irrigation District, North Platte project, Nebr. | 3,109 | 8,000 | 8,000 |
| Annual appropriation or estimate for: | | | |
| General investigations | 5,182,000 | 3,831,000 | 3,742,742 |
| Construction and rehabilitation | 55,000,000 | 85,000,000 | 95,000,000 |
| Operation and maintenance | 22,705,950 | 23,083,483 | 23,072,400 |
| General administrative Expenses | 4,170,795 | 4,374,805 | 4,290,000 |
| Emergency fund | | | |
| Total annual appropriation or estimate | 87,058,745 | 116,289,288 | 126,105,142 |
| Total appropriations | 87,061,854 | 116,397,288 | 126,238,142 |
| Balance carried forward | 125,985,130 | 130,388,611 | 128,889,269 |

TABLE 16.—*Accretions to reclamation fund by States, fiscal year*

| State | Sale of public land | | Proceeds from Oil Leasing Act | | Total June 30 |
|-------------------|---------------------|---------------------|-------------------------------|---------------------|------------------|
| | Fiscal year 1959 | To June 30, 1959 | Fiscal year 1959 | To June 30, 1959 | |
| Alabama..... | | | \$1,435.49 | \$215,324.06 | \$21,435.49 |
| Arizona..... | \$559,484.83 | \$4,409,125.22 | 213,047.07 | 1,069,990.22 | 5,477,546.32 |
| Arkansas..... | | | 24,023.21 | 72,415.96 | 96,439.17 |
| California..... | 917,168.04 | 13,600,933.61 | 4,188,597.70 | 78,702,073.40 | 92,300,607.75 |
| Colorado..... | 262,780.15 | 11,931,062.83 | 5,245,234.94 | 47,130,163.17 | 59,069,139.09 |
| Florida..... | | | 301.74 | 3,205.39 | 3,507.13 |
| Idaho..... | 306,207.07 | 9,213,252.86 | 160,247.30 | 1,336,366.16 | 10,549,069.39 |
| Illinois..... | | | | 74.81 | 74.81 |
| Kansas..... | | 1,046,576.99 | 87,181.09 | 627,506.81 | 1,674,084.89 |
| Louisiana..... | | | 146,725.20 | 1,189,305.19 | 1,336,030.39 |
| Michigan..... | | | 1,129.51 | 32,812.48 | 33,941.99 |
| Mississippi..... | | | 3,111.14 | 26,748.69 | 29,859.83 |
| Montana..... | 126,244.58 | 16,748,842.73 | 2,260,486.61 | 17,124,732.16 | 33,874,361.48 |
| Nebraska..... | 921.60 | 2,220,722.17 | 5,398.05 | 82,279.59 | 2,306,321.31 |
| Nevada..... | 737,040.03 | 3,095,643.80 | 209,659.09 | 3,926,062.00 | 7,022,344.92 |
| New Mexico..... | 236,044.04 | 7,751,594.89 | 6,135,788.03 | 55,022,639.48 | 62,779,466.44 |
| North Dakota..... | 5,016.93 | 12,294,797.30 | 115,343.90 | 1,160,725.97 | 13,464,967.10 |
| Oklahoma..... | 64,747.11 | 6,044,805.06 | 30,006.17 | 317,066.83 | 6,446,625.17 |
| Oregon..... | 921,464.62 | 17,871,941.62 | 39,461.42 | 334,625.49 | 18,203,872.23 |
| South Dakota..... | 9,410.61 | 7,883,139.23 | 116,978.92 | 968,482.72 | 8,881,630.58 |
| Utah..... | 50,515.03 | 5,103,897.94 | 3,242,284.14 | 20,097,567.78 | 25,204,254.89 |
| Washington..... | 260,873.52 | 9,621,266.80 | 8,542.67 | 96,100.95 | 9,976,783.94 |
| Wyoming..... | 52,291.03 | 9,683,588.16 | 16,374,613.91 | 159,868,741.11 | 169,516,233.01 |
| Total..... | 4,510,209.19 | 138,521,191.21 | 38,609,597.30 | 389,405,010.42 | 527,945,808.92 |

| Other accretions | | Fiscal year 1959 | Total June 30 |
|---|--|---------------------|------------------|
| Proceeds, Federal waterpower licenses..... | | \$78,207.97 | \$1,628,207.97 |
| Proceeds, potassium royalties and rentals..... | | 3,339,902.80 | 18,434,902.80 |
| Receipts from naval petroleum reserves, 1920-38, act of May 9, 1938..... | | | 29,700,000.00 |
| Proceeds from rights-of-way over withdrawn lands, act of July 19, 1919..... | | 553.35 | 2,600,553.35 |
| Miscellaneous mineral leasing permits..... | | 70.00 | 17,070.00 |
| Miscellaneous items, other..... | | | 5,000.00 |
| Total..... | | 3,418,734.12 | 49,935,670.02 |
| Grand total..... | | 46,538,540.61 | 577,881,478.94 |

| State and project | Completed works | | | | Construction in progress | Other physical property | Grand total |
|--|-----------------|-----------------|---------------|--------------|--------------------------|-------------------------|-----------------|
| | Multipurpose | Irrigation | Electric | Other plant | | | |
| Total, including loan program | \$1,208,018,533 | \$1,009,560,840 | \$672,142,338 | \$28,745,676 | \$391,589,838 | \$20,937,375 | \$3,330,994,600 |
| Alaska: Eklutna | | | 32,441,083 | | 392,402 | | 32,833,485 |
| Arizona, subtotal | 95,921,583 | 60,704,566 | 102,240,831 | 7,754,900 | 68,589,016 | 210,889 | 335,421,785 |
| Boulder Canyon: | | | | | | | |
| All-American Canal System (California) | 2,179,950 | | | | | | 2,179,950 |
| Hoover Dam and Power plant (Nevada) | 44,552,890 | | 33,615,648 | | | | 78,168,538 |
| Colorado River Front Work and Levee System (California-Nevada) | | | | | | | |
| Colorado River Storage: Glen Canyon Unit (Utah) | | | | (F)6,884,509 | 107,747 | | 6,992,256 |
| Gila | | 44,802,514 | | | 66,475,494 | | 66,475,494 |
| Palo Verde (California) | | 514,992 | | | 1,542,511 | 210,889 | 46,555,914 |
| Parker-Davis (California-Nevada) | | | 64,236,842 | (F)870,391 | | | 1,385,383 |
| Salt River | 44,109,531 | 10,731,853 | 4,266,443 | | 458,467 | | 108,804,840 |
| Yuma (California) | 5,079,212 | 3,513,105 | 121,898 | | | | 20,077,508 |
| Yuma Auxiliary | | 1,142,102 | | | | | 3,635,003 |
| Yuma Projects Office (California) | | | | | 4,797 | | 1,142,102 |
| California, subtotal | 379,764,917 | 211,775,831 | 122,036,271 | 16,270,102 | 114,234,525 | 13,237 | 1,834,094,883 |
| Boulder Canyon: All-American Canal System (Arizona) | | | | (F)3,329,787 | | | 58,492,511 |
| Cachuma | 38,658,714 | 16,504,010 | | | 560,940 | 13,237 | 43,526,756 |
| Central Valley | 42,952,579 | | | | 85,895,235 | | 508,457,884 |
| Colorado River Front Work and Levee System (Arizona-Nevada) | 243,127,344 | 178,454,133 | 101,011,172 | (F)2,924,916 | | | 2,924,916 |
| Klamath (Oregon) | | 6,615,142 | | | 247,655 | | 6,892,797 |
| Newlands (Nevada) | | 196,062 | | | | | 196,062 |
| Orland | | 2,583,870 | | (F)15,399 | 219,455 | | 2,803,325 |
| Palo Verde (Arizona) | | | | | | | 3,027,098 |
| Parker-Davis (Arizona-Nevada) | 6,187,962 | | 20,536,710 | | 74,997 | | 26,759,669 |
| Santa Maria | 11,522,253 | | | | | | 11,522,253 |
| Solano | 37,316,065 | | | | 23,768 | | 37,339,833 |
| Truckee Storage (Nevada) | | 1,092,423 | | | | | 1,092,423 |
| Ventura River | | | | | 27,186,818 | | 27,186,818 |
| Washoe (Nevada) | | | | | | | |
| Yuma (Arizona) | | | | | | | |
| Yuma Projects Office (Arizona) | | 3,318,492 | 488,389 | | | | 3,806,881 |
| California, subtotal | | | | | 25,657 | | 25,657 |

TABLE 17.—*Cost of plant, property and equipment in each State, June 30, 1959—Continued*

| State and project | Completed works | | | | Construction in progress | Other physical property | Grand total |
|--|-----------------|---------------|--------------|--------------|--------------------------|-------------------------|---------------|
| | Multipurpose | Irrigation | Electric | Other plant | | | |
| Colorado, subtotal..... | \$53,427,535 | \$104,301,543 | \$43,976,499 | ..... | \$7,154,735 | \$6,009 | \$208,866,321 |
| Colbran..... | ..... | ..... | ..... | ..... | ..... | ..... | 4,560,353 |
| Colorado-Big Thompson..... | 36,268,545 | 80,372,580 | 42,981,004 | ..... | 4,560,353 | 6,009 | 139,043,951 |
| Colorado River Storage: Navajo Unit (New Mexico) | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Fruitgrowers Dam..... | 200,309 | ..... | ..... | ..... | ..... | ..... | 200,309 |
| Grand Valley..... | 5,781,100 | ..... | 213,670 | ..... | ..... | ..... | 6,212,058 |
| Manitou..... | 3,915,061 | ..... | ..... | ..... | ..... | ..... | 3,915,061 |
| Missouri River Basin..... | 13,289,470 | ..... | 781,825 | ..... | 217,288 | ..... | 14,866,774 |
| Paonia..... | 1,599,704 | ..... | ..... | ..... | 795,479 | ..... | 3,163,910 |
| Pine River..... | 3,466,830 | ..... | ..... | ..... | 1,564,206 | ..... | 3,466,830 |
| San Luis Valley..... | 3,869,520 | ..... | ..... | ..... | 1,596 | ..... | 3,871,116 |
| Uncompagre..... | ..... | 8,965,959 | ..... | ..... | ..... | ..... | 8,965,959 |
| Idaho, subtotal..... | 86,696,478 | 52,043,754 | 23,688,711 | \$1,020,096 | 8,847,717 | 27,978 | 172,324,734 |
| Avondale..... | 244,424 | ..... | ..... | ..... | ..... | ..... | 244,424 |
| Boise (Oregon)..... | 33,354,149 | 26,239,138 | 5,095,693 | ..... | 1,267,676 | ..... | 65,956,656 |
| Dalton Gardens..... | ..... | 258,660 | ..... | ..... | ..... | ..... | 258,660 |
| King Hill..... | ..... | 1,877,732 | ..... | ..... | ..... | ..... | 1,877,732 |
| Lewisston Oreharis..... | 426,999 | 1,037,302 | ..... | (M)1,020,096 | ..... | ..... | 2,484,397 |
| Little Wood River..... | ..... | ..... | ..... | ..... | 1,477,180 | ..... | 1,477,180 |
| Michaud Flats..... | 3,646,554 | ..... | ..... | ..... | 317,494 | ..... | 3,964,048 |
| Minidoka (Wyoming)..... | 8,719,792 | 16,274,922 | 3,116,182 | ..... | 5,070,833 | 27,978 | 33,209,707 |
| Owyhee (Oregon)..... | ..... | 1,033,291 | ..... | ..... | ..... | ..... | 1,033,291 |
| Palisades (Wyoming)..... | 44,195,538 | ..... | 15,476,836 | ..... | 710,526 | ..... | 60,382,900 |
| Preston Bench..... | ..... | 450,100 | ..... | ..... | ..... | ..... | 450,100 |
| Rathdrum Prairie..... | ..... | 981,631 | ..... | ..... | 4,008 | ..... | 985,639 |
| Iowa: | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Missouri River Basin Transmission Lines..... | ..... | ..... | 2,321,716 | ..... | 853,309 | ..... | 3,175,025 |
| Kansas, subtotal..... | 45,413,437 | 16,461,396 | ..... | ..... | 4,146,219 | ..... | 66,021,052 |
| Garden City..... | ..... | 334,475 | ..... | ..... | ..... | ..... | 334,475 |
| Missouri River Basin..... | 45,413,437 | 16,126,921 | ..... | ..... | 4,146,219 | ..... | 65,686,577 |
| Minnesota: | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Missouri River Basin Transmission Lines..... | ..... | ..... | 3,487,426 | ..... | 4,456,013 | ..... | 7,943,439 |

| | | | | | |
|---|------------|------------|------------|------------|-------------|
| Frenchtown | 79,356,106 | 279,321 | 10,630,278 | 63,588 | 1,201,000 |
| Hungry Horse | | | | 1,755,882 | 4,991,420 |
| Huntley | | | | 148,303 | 12,386,160 |
| Intake | | | | 6,449 | 101,689,113 |
| Lower Yellowstone (North Dakota) | | | | 90,491 | 1,919,819 |
| Milk River | 2,001,917 | 1,829,328 | 22,178,255 | 94,213 | 94,213 |
| Missoula Valley | | 3,031,353 | | 65,850 | 3,031,353 |
| Missouri River Basin | | 7,424,992 | | 278,321 | 9,492,759 |
| Shoshone (Wyoming) | 46,802,083 | 3,942,801 | 8,978,210 | 7,769,940 | 67,724,737 |
| Sun River | | 16,400 | | 15,400 | 15,400 |
| | | 10,222,114 | | 2,848 | 10,224,962 |
| Nebraska, subtotal | 37,081,183 | 52,384,844 | 7,609,434 | 9,445,143 | 106,520,604 |
| Mirage Flats | | 3,061,614 | | | 3,061,614 |
| Missouri River Basin | 37,081,183 | 39,592,955 | 7,358,766 | 9,444,998 | 93,477,902 |
| North Platte (Wyoming) | | 9,730,275 | 250,668 | 145 | 9,981,088 |
| Nevada, subtotal | 49,919,065 | 8,599,589 | 38,031,146 | 642,231 | 104,684,408 |
| Boulder Canyon: | | | | | |
| Hoover Dam and Powerplant (Arizona) | 49,919,065 | | 32,123,184 | 296,335 | 84,049,387 |
| Boulder City Municipal | | | | | 5,746,614 |
| Colorado River Front Work and Levee System (California-Arizona) | | | | | |
| Humboldt | | 1,337,320 | | | 1,337,320 |
| Newlands (California) | | 7,262,269 | 341,751 | 8,913 | 7,638,980 |
| Parker-Davis (Arizona-California) | | | 5,566,211 | | 5,575,124 |
| Truckee Storage (California) | | | | 336,983 | 336,983 |
| Washoe (California) | | | | | |
| New Mexico, subtotal | 17,045,839 | 39,945,855 | 8,037,163 | 272,927 | 85,188,473 |
| Carlsbad | | | | | |
| Colorado River Storage: Navajo Unit (Colorado) | 3,179,992 | 2,059,600 | | 9,119,676 | 5,239,592 |
| Fort Sumner | | 2,372,069 | | 339,377 | 9,119,676 |
| Hondo | | 339,377 | | | 2,372,069 |
| McMillan Delta | | | | 215,504 | 339,377 |
| Middle Rio Grande | 4,300,433 | 12,591,279 | | 10,259,306 | 27,151,018 |
| Rio Grande (Texas) | 8,166,940 | 6,019,826 | | 280,203 | 22,777,059 |
| Tucumanari | | 15,474,082 | 8,037,163 | (F)272,927 | 15,474,082 |
| Verniejo | 1,398,474 | 8,089,622 | | 12,000 | 2,500,096 |

TABLE 17.—*Cost of plant, property and equipment in each State, June 30, 1959—Continued*

| State and project | Completed works | | | | Construction in progress | Other physical property | Grand total |
|--|-----------------|-------------|--------------|-------------|--------------------------|-------------------------|--------------|
| | Multipurpose | Irrigation | Electric | Other plant | | | |
| North Dakota, subtotal | \$8,393,268 | \$3,407,941 | \$30,694,818 | \$41,558 | \$4,988,863 | \$199,652 | \$47,736,100 |
| Buford-Trenton | | 1,080,968 | | | 53,593 | | 1,134,561 |
| Buford-Trenton (old) | | 223,423 | | | | | 223,423 |
| Fort Peck (Montana) | | | 1,548,980 | | 7,701 | | 1,556,681 |
| Lower Yellowstone (Montana) | | 554,574 | | | | | 554,574 |
| Missouri River Basin | 8,393,268 | 1,139,881 | 29,145,838 | (FW)41,558 | 4,927,569 | 199,652 | 43,847,766 |
| Williston | | 409,095 | | | | | 409,095 |
| Oklahoma, subtotal | 6,958,533 | 5,136,166 | | 152,026 | 11,200,086 | | 23,446,811 |
| W. C. Austin | 6,958,533 | 5,136,166 | | (M)152,026 | 11,200,086 | | 12,246,725 |
| Washita Basin | | | | | | | 11,200,086 |
| Oregon, subtotal | 34,303 | 50,640,901 | 607,269 | | 19,827,167 | 13,332 | 71,122,972 |
| Arnold ² | | | | | 2,252 | | 2,252 |
| Baker | | 225,015 | | | 225,015 | | 225,015 |
| Boise (Idaho) | | 4,275 | | | 4,275 | | 4,275 |
| Burnt River | | 601,026 | | | 601,026 | | 601,026 |
| Crescent Lake Dam | | 319,936 | | | 319,936 | | 319,936 |
| Crooked River (includes Ochoco) | | | 447,366 | | 2,513,278 | | 2,960,644 |
| Deschutes | | 12,898,721 | 67,938 | | | | 12,966,659 |
| Grants Pass—Savage Rapids Dam ² | | | | | | | |
| Klamath (California) | | 8,039,634 | 91,965 | | | 13,332 | 8,144,931 |
| Ochoco (See Crooked River) | | | | | | | |
| Owyhee (Idaho) | | 18,285,942 | | | 12,057 | | 18,297,999 |
| Rogue River | | 216,535 | | | 16,932,399 | | 17,183,237 |
| Umatilla | 34,303 | 5,182,993 | | | 15,301 | | 5,198,294 |
| Vale | | 4,806,824 | | | | | 4,806,824 |
| Wapinitia, Juniper Division | | | | | 351,880 | | 351,880 |
| South Dakota, subtotal | 25,391,180 | 9,139,255 | 43,294,173 | 36,070 | 5,294,633 | 54,495 | 83,209,806 |
| Belle Fourche | | 5,038,107 | | | | | 5,038,107 |
| Missouri River Basin | 24,470,956 | 4,101,148 | 43,294,173 | (FW)36,070 | 5,294,633 | 54,495 | 77,251,475 |
| Rapid Valley | 920,224 | | | | | | 920,224 |
| Texas, subtotal | 23,439,644 | 5,023,208 | | | 760,956 | | 29,223,808 |
| | | | | | | | 406,533 |

| SAN ANGELO | NO. OF FEET | AREA IN ACRES | ACREAGE | 12,808,751 | 31,886,458 | 61,085 | 95,533,577 |
|---|-------------|---------------|-------------|---------------|------------|--------|-------------|
| Central Utah, Vernal Unit | | | | | | | |
| Colorado River Storage: | | | | | | | |
| Glen Canyon Unit (Arizona) | | | | | | | |
| Flaming Gorge Unit (Wyoming) | | | | | | | |
| Transmission Division | | | | | | | |
| Hyrum | | | 953,854 | | | | 6,792,981 |
| Moon Lake | | | 1,790,859 | | | | 458,227 |
| Newton | | | 712,592 | | | | 953,854 |
| Ogden River | | | 5,000,984 | | | | 1,799,859 |
| Provo River | | | 3,710,321 | | | | 712,592 |
| Sanpete | | | 433,940 | (M)12,868,751 | | | 5,150,912 |
| Scofield | | | 943,837 | | | | 33,969,467 |
| Strawberry Valley | | | 3,332,530 | | | | 433,940 |
| Weber Basin | | | 14,289,585 | | | | 943,837 |
| Weber River | | | 2,723,486 | | | | 3,485,419 |
| | | | | | | | 37,034,027 |
| | | | | | | | 2,723,486 |
| Washington, subtotal | | | | 325,888 | | | 593,253,993 |
| | | | | | | | |
| Chief Joseph Dam, Foster Creek | | | | | | | |
| Columbia Basin | | | 2,445,363 | | | | 2,473,212 |
| Kokanee | | | 221,209,820 | | | | 527,900,089 |
| Okanogan | | | 1,498,251 | | | | 1,519,034 |
| Yakima | | | 45,813,366 | | | | 61,361,658 |
| | | | | | | | |
| | | | | | | | |
| Wyoming, subtotal | | | | 57,850,646 | | | 211,010,365 |
| | | | | | | | |
| Colorado River Storage: Flaming Gorge Unit (Utah) | | | | | | | |
| Eden | | | 7,053,908 | | | | 7,761,845 |
| Kendrick | | | 10,167,642 | | | | 30,921,395 |
| Minidoka (Idaho) | | | 2,246,462 | | | | 2,246,462 |
| Missouri River Basin | | | 45,651,879 | | | | 109,677,348 |
| North Platte (Nebraska) | | | 1,768,305 | | | | 13,815,888 |
| Palisades (Idaho) | | | 841,193 | | | | 841,193 |
| Riverton | | | 2,935,169 | | | | 23,234,382 |
| Shoshone (Montana) | | | 1,560,085 | | | | 22,511,852 |
| | | | | | | | |
| Nonproject property | | | | | | | |
| | | | | | | | |
| Subtotal | | | | | | | |
| Loan program | | | | | | | |
| Total, including loan program | | | | | | | |

¹ Excludes San Diego \$30,532,659 transferred from the Navy Department for administration of repayment contract.

² Construction costs classified as funded operation and maintenance charges.

NOTES.—Name of State in which balance of project is located is indicated by parentheses (except Missouri River Basin, located in 40 States). Irrigation plant is listed at gross construction cost prior to deduction of charge-offs authorized by Congress. Municipal and industrial water plant (MI) totals \$14,400,873; flood control plant (F) totals \$14,297,929 and fish and wildlife (FW) totals \$406,874.

Statistics

Legislative references on project authorizations and related items together with financial and employment statistics on Bureau operations and those reflecting physical progress and program accomplishments on all Bureau activities were kept up to date.

To supplement the Bureau's publications on Reclamation Law, Project Feasibilities and Authorizations, Appropriation Acts, Allotments and Repayments—of which new editions are published periodically—the time series of statistical data published in the report annually 1902 through 1957 and since omitted, are now being published in the Statistical Appendix to this report for use within and outside of the Government. A new edition of Reclamation Appropriation Acts and Allotments for publication in 1960 and expansion of the Statistical Appendix to include individual sheets on each project, were undertaken. Under the program of continuing research to establish and refine important historical data, those on allotments made to Missouri River Basin Project, by activity, by units, and by years were completed. Trend and forecast studies on financial and employment matters such as potential future financing of Reclamation programs from its special fund receipt accounts, and staffing, were made for administrative purposes.

Physical progress and program accomplishments were evaluated monthly and published in the Bureau's Monthly Report on Progress and Status of Funds, and the Bureau's Quarterly "Progress" report, the summary data being included in the Statistical Appendix to this report. As an aid to financial management, the Forecast of Utilization of Investigations Funds and that for Operation and Maintenance Funds were initiated, supplementing the previously established Forecast of Utilization of Construction Funds. Trends and forecast studies on program expenditures for the current and budget year, special reports and chart presentations on programs, funds, employment and staff guidance within the Bureau on preparation and analysis of statistical data were continued.

Division of Foreign Activities

In recognition of the Bureau of Reclamation's reputation in the development of water resources and related technical and administrative fields, the governments of 35 countries have, during the past year, requested Bureau assistance through the aid program of the U.S. Government and various international organizations. This requested assistance has consisted of (1) the training and development of foreign nations in the techniques, practices, and pro-

tures of the Bureau of Reclamation, (2) the undertaking of laboratory studies, design review and other technical advice to agencies foreign governments, and (3) the selection of Bureau employees act as technical advisers, and to be part of actual work teams engaged in the training of foreign nationals and advising government bureaus in planning and construction of irrigation and power projects in other lands.

The Division of Foreign Activities is responsible for administering the Bureau's participation in these programs. Fulfillment of these requests is accomplished to the greatest extent possible without interference with the domestic program. All such assistance is financed from sources outside the regular Reclamation appropriation.

The past year has seen the Washington, Denver, Regional and Project Offices provide on-the-job training to 86 technicians and administrators from 33 countries, and 215 additional individuals have spent short periods of observation and consultation in various Bureau offices. These participants return home to staff the agencies responsible for the development of their country's resources to meet the steadily increasing demands for more food, more fiber, and more power. Many former "students" of this Reclamation training program are now in responsible positions in their homelands, and are leading figures behind their respective governments' resource development activities.

This export of technical knowledge also was accomplished by sending 23 Bureau employees to 12 countries to advise on problems of design, construction, land settlement, irrigation law, organization, and the preparation of technical manual material. In addition, 6 engineers were on extended assignments providing advisory services on construction projects in Taiwan and Australia, and a team of 9 was initiating a reconnaissance survey of the Blue Nile River Basin in Ethiopia. The work in Taiwan and Ethiopia is under auspices of the International Cooperation Administration, while the Australia assignments are arranged through the International Educational Exchange Service, under authority of Public Law 402, 80th Congress. In addition, the Assistant Commissioner and Chief Engineer's office in Denver has provided a variety of technical services, including laboratory tests, design review, advice on specific technical problems, and supply of numerous technical publications.

Organization and Management

Organization and management studies were continued. Of particular significance, the Department, at the request of the Bureau,

conducted a study of regions 6 and 7 in the Missouri River Basin and the Office of the Commissioner, Denver, Colo. The Bureau was represented in the survey team, which made 17 recommendations dealing with the organization, management, staffing, financing and budget activities of the Bureau. Local organization surveys were performed by regional offices.

Offices were established as follows: Wenatchee Project Office, Wenatchee, Wash.; Little Wood Project Office, Carey, Idaho; Dorado Distribution System Project Office, Placerville, Calif.; Lower Rio Grande Rehabilitation Project, Weslaco, Tex.; San Angelo Project Office, San Angelo, Tex.; Farwell Project Office, Paul, Nebr.; Ainsworth Project Office, Ainsworth, Nebr.; Proctor Creek Field Division, near Truckee, Calif.; Vernal Field Division, Vernal, Utah; Collbran Field Division, Collbran, Colo.; and Paonia Field Division, Paonia, Colo. The following offices were closed: Santa Maria Project Office, Santa Maria, Calif.; Solano Project Office, Winters, Calif.; and Sargent Irrigation Operations Field Branch, Sargent, Nebr.

New portions were prepared for the Reclamation Instructions covering basic policies and procedures which govern Bureau activities. Contracts, procurement and property management received primary attention in the preparation of instructions and guidelines. A comprehensive index to the entire Reclamation Instructions system was distributed.

Problems were identified through the Management Improvement Program, and projects were scheduled to improve the performance of the Bureau's work. A forms review project was initiated to eliminate obsolete and rarely used forms. Special assignments of a varying nature increased, with considerable attention given to outside employment matters, and staffing analyses.

A total of 1,087 suggestions for the improvement of Bureau activities and procedures were received during the year. Approximately 35 percent of these were adopted and the employees proposing the improvements were awarded \$11,130. The adopted suggestions resulted in an estimated annual savings of \$97,838 in addition to substantial intangible benefits. Superior Performance cash awards were granted to 311 employees.

Personnel

The continued utilization of carefully planned staffing controls resulted in a further decline in Bureau employment during the year 1959. At the beginning of the year there were 10,125 full-time employees on the rolls; at the end of the year the figure was 9,175.

surplus employee placement program enabled the Bureau to move many employees from areas with declining workloads to those of increasing activity. The decrease in the number of employees was accomplished systematically, mainly through attrition, and did not require extensive use of reduction-in-force procedures.

The passage of the Government Employees Training Act, early fiscal year 1959, provided the Bureau with greater opportunities to promote efficiency, increase production, improve supervision, and better communications through greater emphasis on training activities. Following enactment of the legislation, a comprehensive review of the Bureau's training needs and requirements was conducted. The results of the survey and the authority granted by the Training Act were used as the basis for strengthening Bureau service training programs, for instituting new ones where a need was evident, and for increasing participation by employees at training programs in non-Government facilities.

The Bureau's new merit promotion program went into effect on January 1, 1959, in accordance with instructions of the Civil Service Commission. One promotion plan covers positions Bureauwide at grades GS-9 and above and provides for a centralized roster of qualifications information on employees at grades GS-12 and above. Promotion plans covering positions at GS-8 and below and wage and job grades were developed and are being administered on a decentralized basis.

An extensive college relations program, primarily designed for recruiting beginning engineers, was continued at colleges and universities during the year. Recruiting teams interviewed students at schools both inside and outside the reclamation area. The Bureau goal for hiring entrance level engineers was substantially realized.

Audit and Financial Review

Forty-five assignments were completed by the field staff during the fiscal year. They consisted of 34 comprehensive project audits; 1 financial audit of a water users' organization, made at its request; 9 special assignments; and assistance to a water users' organization in expansion of its accounting system to meet requirements under Small Projects Act loan agreement.

The Washington staff and the personnel of the Denver staff also provided, throughout the year, assistance on Bureau financial and accounting problems, including studies regarding electronic data processing machine applications. Additionally, one auditor was detailed to assist another agency of the Department in developing its audit program.

General Services

During the fiscal year the Bureau received and created 9,700 cubic feet of records; disposed of 10,900 cubic feet; transferred to Federal records centers and National Archives for custody and service 2,100 cubic feet; and transferred to other Government agencies, water users' organizations, etc., 59 cubic feet. These resulted in a decrease in volume of records held by all Bureau offices from 94,160 to 91,000 cubic feet.

In response to 1,004 requests, 15,405 copies of Bureau publications were distributed from our Washington office. Of these requests, 140 were of congressional origin for 521 publications and 162 from agencies of the executive branch of the Federal Government for 3,792 copies.

In response to 6,425 requests for the Bureau's publications and informational materials received from individuals in this country and in foreign countries, more than 33,000 copies of technical publications and informational pamphlets were sold or distributed in Denver. Sales of Bureau publications totalled \$23,202, approximately one-half of this total being made to foreign countries. Sales of publications sold for the Superintendent of Documents totalled \$4,630.

Three thousand one hundred twenty-seven photographic prints were provided for reproduction in Bureau publications, non-Government textbooks and encyclopedias, various agricultural and engineering magazines and newspapers, and to supplement exhibits and lectures. Requests by mail and in person for visual material were also received from congressional offices and from agencies of the executive branch of the Federal Government.

Eight hundred and thirty motion picture films were distributed to television stations, agricultural and engineering institutions, water users' associations, organizations of farmers, and to conventions in the United States and abroad.

Legal

During the fiscal year, which included approximately the last 2 months of the 2d session of the 85th Congress and the first 6 months of the 86th Congress, several legislative proposals of importance to the Bureau of Reclamation were enacted into law:

Of interest generally are:

Title III of Public Law 85-500, called the Water Supply Act of 1958, which authorizes the Bureau of Reclamation to include pro-

sion in any reservoir to be constructed by it for future municipal and industrial water requirements, the cost of such provision for future needs to be deferred until that supply is first used.

Public Law 85-611, which permits the use of variable repayment plans in existing and proposed repayment contracts under section (1) of the Reclamation Project Act of 1939 and repayment contracts under the Water Conservation and Utilization Act.

With respect to specific projects, the Congress enacted legislation authorizing the construction and operation of Gray Reef Dam and Reservoir as a feature of the Glendo unit, Wyoming, Missouri River Basin project (Public Law 85-695); amended the authorization of the Washoe project, Nevada, to increase the amounts which may be appropriated therefor (Public Law 85-706); approved the report on the feasibility of the Red Willow Dam and Reservoir, Nebraska (Public Law 85-789); authorized the transfer to the United States of the necessary right-of-way for Yellowtail Dam and Reservoir, Missouri River Basin project, and the payment to the Crow Indian Tribe for such right-of-way (Public Law 85-523); and authorized, in connection with the construction of the Seedskaadee project, Wyoming, the acquisition of privately owned land in the project area, the disposal of that and other federally owned land in connection with a farm settlement program on the project, and the establishment of the maximum size of farm units in single ownership which may be served with project water (Public Law 85-797). Authorization was granted to execute the repayment contract negotiated with the Heart Mountain Irrigation District, Wyoming (Public Law 85-889), and to amend the repayment contract with the Hurley Conservancy District (Public Law 85-663).

Of special interest is the enactment of Public Law 85-900, which was designed to facilitate the early incorporation of Boulder City under the laws of the State of Nevada in order that the United States may withdraw from the administration of that community.

Litigation

Rank v. Krug, et al. The history of this case appears in the 1956 Annual Report of the Secretary, page 62. Supplemental information appears in the 1957 Annual Report, page 88, and the 1958 Annual Report, page 57. The United States and its codefendants (water-user organizations beneficiary to the operations of the Central Valley project, particularly as to the operations at Font Dam and Friant-Kern and Madera Canals) have appealed this case to the Ninth Circuit Court of Appeals. The complete record on appeal has not yet reached the offices of the court of appeals.

2. *State of California v. United States*, District Court for Northern District of California, No. 7264. The history of this action appears in the 1958 Annual Report of the Secretary, page 59. The case has not yet been set for trial.

3. *Citizens Utilities Company v. United States*, United States Court of Claims, No. 364-55. This action was filed in the Court of Claims September 30, 1955, for damages totaling \$12,216,775 allegedly to have been sustained as a result of the wrongful and unlawful failure and refusal of the United States to renew its contract for purchase of Metropolitan Water District unused Hoover Dam energy, which contract by express terms of limitation had expired December 31, 1954. On March 6, 1957, the court of claims held in favor of the plaintiff. Request for rehearing was denied on June 1, 1957; a petition for writ of certiorari was denied by the United States Supreme Court on December 9, 1957.

Negotiations for the resumption of delivery of Metropolitan Water District unused energy to the Company were carried on after denial of certiorari. Although agreement had not been reached on an arrangement which would dispose all issues, the Company was advised that the United States would be willing to resume delivery of such energy on June 1, 1958, with the understanding that the respective positions of the Company and the United States would not be prejudiced thereby. The Company accepted this offer and delivery to it was resumed on June 1, 1958.

The Company filed its Schedule of Damages in February 1958.

4. *State of Arizona, Plaintiff v. State of California, et al.* No. 93-100, Original, Supreme Court of the United States. In this action Arizona is seeking a determination of its rights in and to the use of the waters of the Colorado River, as against such rights claimed by the defendants, under the Colorado River Compact, the Boulder Canyon Project Act, and the California Limitation Act. Trial of the case before Special Master Simon H. Rifkind was concluded in August 1958. Thereafter, proposed findings of fact and conclusions of law, and briefs were filed with the Special Master by all parties.

5. *The Ivanhoe Irrigation District v. All Parties and Persons, et al. and related cases*. The history of this case appears in the 1958 Annual Report of the Secretary at page 60. Late in 1958 a petition for rehearing and clarification was filed with the Supreme Court of California by attorneys representing the protesting landowners in the several districts. The petition raises questions, among other things, on the authority of the irrigation districts to enter into contracts and the validity of election notices. The submission of briefs and presentation of oral arguments have been completed. A decision has been issued yet by the Court.

3. *J. W. Wheeler Co. v. Jean Lee Knight Tripp, Defendant and Third Party Plaintiff, and United States, Third Party Defendant.* The defendant's complaint against the additional defendant, United States, was filed in the United States District Court, W.D. Washington, Northern Division, Seattle, Wash., in May 1958, for the purpose of having a recordable contract on certain Columbia Basin project land owned by the plaintiff declared a nullity because of alleged failure of the United States to plat it as a farm unit and construct irrigation facilities to serve it under the recordable contract between the United States and the original landowner entered into in April 1946. The Court granted a motion to dismiss the United States from the case on jurisdictional grounds, and a motion for summary judgment in favor of the plaintiff upholding the recordable contract and allowing recovery of the excess consideration paid for the land in violation thereof.

Bonneville Power Administration

William A. Pearl, *Administrator*



GROSS REVENUES of the Department of the Interior's Bonneville Power Administration for the fiscal year 1959, pending final audit, were \$67,966,291, representing an increase of \$1,391,157 or 2.05 percent over the gross revenues for the previous year.

After providing for all expenses of operation, including maintenance, interest, depreciation and miscellaneous charges, the net deficit for 1959 was \$7,302,572 as compared with a net deficit of \$8,315,204 for 1958. The reduction of \$1,012,632 in the deficit was accounted for by the fact that revenues increased \$279,632 more than expenses, while the aggregate amount allocated to general projects was reduced by \$733,000.

This net decrease of \$733,000 in allocations to generating projects resulted from the following principal factors:

1. The scheduled annual payout requirements for the McNary and The Dalles projects were reduced because changes in the tentative cost allocations decreased the amount of construction costs and operation and maintenance expenses allocated to power for these projects.

2. Revenues allocated in fiscal year 1958 were more than sufficient to meet some of the projects' payout requirements for that year. Therefore, in fiscal year 1959 the allocations of revenues to these projects were reduced to the normal payout requirements.

3. For some of the projects the allocations of revenues were increased because of the addition of more generating facilities.

4. Inasmuch as system revenues were insufficient after paying for operation and maintenance and interest expenses to meet the regularly scheduled amortization requirements for all of the projects and the BPA transmission system, the amounts of revenues allocated to the Bonneville Dam and McNary Dam projects were reduced. The system deficiency was prorated among these two projects and 1 A

the amounts required to absorb the deficiency inasmuch as each was substantially ahead of its scheduled payout requirements as of June 30, 1958. However, the amounts allocated to these two projects and BPA were sufficient to pay a portion of their scheduled amortization for 1959 and all three continued to be considerably ahead of their amortization schedules as of June 30, 1959.

Statement of Revenues and Expenses

Table I presents a condensed statement of revenues and expenses together with cumulative totals from inception of the Bonneville Power Administration to June 30, 1959. The operating revenues, expenses for operation, maintenance, depreciation and interest, and the net revenues shown in this table are for the Bonneville Power Administration only and not for the Columbia River power system. Similarly, the data shown in tables II to V, inclusive, also apply to the Bonneville Power Administration only. The amounts shown in Table I as allocated to the generating projects are applied in the accounts of those projects to the return of their expenses for operation, maintenance, and interest and to the repayment of construction costs.

Summary of Revenue

Table II summarizes revenues by class of customer by fiscal years and including 1959. Industrial customers accounted for 39.47 percent of the revenue dollar for fiscal year 1959; the aluminum industry provided 24.44 percent and other industries 15.03 percent. Sales to publicly owned utilities were 37.71 percent of the total revenue for 1959, and sales to privately owned utilities were 20.44 percent. Other operating revenues amounted to 2.38 percent of the total for 1959.

TABLE I.—*Bonneville Power Administration—condensed comparative summary of revenues and expenses, fiscal years 1958 and 1959, and cumulative totals from inception to June 30, 1959 (preliminary)*

| | Fiscal year 1958 | Fiscal year 1959 | Increase or (decrease) | Cumulative total to June 30, 1959 |
|---|---------------------|---------------------|------------------------------|---|
| Operating revenues..... | \$66,575,134 | \$67,966,291 | \$1,391,157 | \$663,044,075 |
| Less amounts allocated to generating projects..... | 45,475,000 | 44,742,000 | (733,000) | 356,127,320 |
| Operating revenues allocated to BPA..... | 21,100,134 | 23,224,291 | 2,124,157 | 306,916,755 |
| Expenses of operation, maintenance, etc..... | 10,310,832 | 10,517,937 | 207,105 | 119,220,190 |
| Expense for depreciation..... | 11,606,270 | 11,934,218 | 327,948 | 97,841,445 |
| Interest expense..... | 7,498,236 | 8,074,708 | 576,472 | 65,799,646 |
| Total deductions..... | 29,415,338 | 30,526,863 | 1,111,525 | 282,861,281 |
| Net revenues..... | (8,315,204) | (7,302,572) | 1,012,632 | 24,055,474 |

TABLE II.—*Bonneville Power Administration—revenue by class of customer through fiscal year 1959 (preliminary)*

| Class of customer | 1954 and prior years | 1955 | 1956 | 1957 | 1958 | 1959 | Total to June 30, 1959 | Per district 1 to rev |
|--------------------------------|----------------------|--------------|--------------|--------------|--------------|--------------|------------------------|-----------------------|
| Industry: | | | | | | | | |
| Aluminum..... | \$143,938,965 | \$16,909,588 | \$20,098,110 | \$20,025,700 | \$17,491,535 | \$16,611,144 | \$235,075,042 | |
| Other ¹ | 39, 673, 399 | 6, 821, 850 | 8, 186, 874 | 8, 451, 336 | 9, 466, 846 | 10, 216, 244 | 82, 816, 549 | |
| Publicly owned utilities..... | 80, 708, 669 | 17, 601, 135 | 19, 505, 231 | 22, 044, 831 | 23, 574, 281 | 25, 629, 526 | 189, 063, 673 | |
| Privately owned utilities..... | 77, 393, 420 | 9, 926, 150 | 11, 999, 475 | 14, 450, 108 | 14, 171, 346 | 13, 892, 865 | 141, 833, 364 | |
| Other operating revenue..... | 7, 705, 440 | 719, 332 | 1, 044, 307 | 1, 298, 730 | 1, 871, 126 | 1, 616, 512 | 14, 255, 447 | |
| Total operating revenues..... | 349, 419, 893 | 51, 978, 055 | 60, 833, 997 | 66, 270, 705 | 66, 575, 134 | 67, 966, 291 | 663, 044, 075 | |

¹ Includes sales to Federal agencies.TABLE III.—*Bonneville Power Administration—summary of Federal investment in transmission system and repayment as of June 30, 1959 (preliminary)*

| | Gross investment | Repayments | Net investment |
|---|------------------|-----------------|-----------------|
| Investment in current expenses: | | | |
| Operation, maintenance, etc..... | \$100, 321, 402 | \$100, 321, 402 | |
| Interest..... | 55, 799, 646 | 65, 799, 646 | |
| Total current expenses..... | 166, 121, 048 | 166, 121, 048 | |
| Investment in capital assets: | | | |
| Electric plant investment and other capital assets..... | 484, 986, 237 | 121, 391, 077 | \$363, 595, 160 |
| Unexpended appropriations..... | 16, 155, 245 | | 16, 155, 245 |
| Total capital investment..... | 501, 141, 482 | 121, 391, 077 | 379, 750, 405 |
| Total Federal investment..... | 667, 262, 530 | 287, 512, 125 | 379, 750, 405 |

¹ Consists of \$78,280,000 scheduled amortization and \$43,111,077 repaid in excess of scheduled requirements. The total repayment, \$121,391,077, equals 25 percent of the invested capital of \$484,986,237.TABLE IV.—*Bonneville Power Administration—condensed statement of assets and liabilities as of June 30, 1958 and 1959 (preliminary)*

| | June 30, 1958 | June 30, 1959 | Increase or decrease |
|--|-----------------|-----------------|----------------------|
| ASSETS | | | |
| Electric Plant—original cost..... | \$443, 133, 054 | \$461, 479, 378 | \$18, 346, 324 |
| Less: Reserve for depreciation..... | 74, 298, 048 | 86, 051, 373 | 11, 753, 325 |
| Original cost less reserve..... | 368, 835, 006 | 375, 428, 005 | 6, 592, 999 |
| Current assets..... | 30, 242, 500 | 31, 594, 790 | 1, 352, 290 |
| Deferred charges, special funds, etc..... | 3, 338, 451 | 2, 789, 135 | (549, 316) |
| Total assets..... | 402, 415, 957 | 409, 811, 930 | 7, 395, 973 |
| LIABILITIES AND OTHER CREDITS | | | |
| Net investment of the U.S. Government..... | 361, 965, 702 | 379, 750, 405 | 17, 784, 703 |
| Current liabilities..... | 8, 352, 718 | 5, 980, 686 | (2, 372, 032) |
| Reserves and other credits..... | 739, 491 | 25, 365 | (714, 126) |
| Accumulated net revenues..... | 31, 358, 046 | 24, 055, 474 | (7, 302, 572) |
| Total liabilities and other credits..... | 402, 415, 957 | 409, 811, 930 | 7, 395, 973 |

TABLE V.—*Bonneville Power Administration—sales of electric energy—firm and nonfirm by class of customer, fiscal years 1958 and 1959 (preliminary)*

[In thousands]

| Class of customer | Fiscal year 1958 | Fiscal year 1959 | Amount of increase or (decrease) | Percent increase or (decrease) |
|--------------------------------------|------------------|------------------|----------------------------------|--------------------------------|
| Minimum industry: | | | | |
| Firm..... | \$13,980 | \$14,227 | \$247 | 1.77 |
| Nonfirm..... | 3,512 | 2,384 | (1,128) | (32.12) |
| Total aluminum industry..... | 17,492 | 16,611 | (881) | (5.04) |
| Other industry: | | | | |
| Firm..... | 3,006 | 3,138 | 132 | 4.39 |
| Nonfirm..... | 407 | 675 | 268 | 65.85 |
| Total other industry..... | 3,413 | 3,813 | 400 | 11.73 |
| Publicly owned utilities: | | | | |
| Firm..... | 22,593 | 24,861 | 2,268 | 10.04 |
| Nonfirm..... | 981 | 769 | (212) | (21.61) |
| Total publicly owned utilities..... | 23,574 | 25,630 | 2,056 | 8.72 |
| Privately owned utilities: | | | | |
| Firm..... | 11,364 | 11,306 | (58) | (.51) |
| Nonfirm..... | 2,807 | 2,587 | (220) | (7.84) |
| Total privately owned utilities..... | 14,171 | 13,893 | (278) | (1.96) |
| Federal agencies: | | | | |
| Firm..... | 5,860 | 6,015 | 155 | 2.64 |
| Nonfirm..... | 194 | 388 | 194 | 100.00 |
| Total Federal agencies..... | 6,054 | 6,403 | 349 | 5.76 |
| Total sales of electric energy: | | | | |
| Firm..... | 56,803 | 59,547 | 2,744 | 4.83 |
| Nonfirm..... | 7,901 | 6,803 | (1,098) | (13.90) |
| Total sales of electric energy..... | 64,704 | 66,350 | 1,646 | 2.54 |

Total energy sales increased in 1959 over 1958 by \$1,645,771. However, sales to the aluminum industry and to privately owned utilities decreased \$880,391 and \$278,481, respectively. Sales to other industries increased \$749,398 and to publicly owned utilities by \$2,055,245. Revenues from sources other than energy sales decreased \$254,614, with the result that total operating revenues gained only \$1,391,157.

Repayment of Federal Investment

The gross Federal investment in the transmission facilities operated by the Bonneville Power Administration is comprised of the total of all funds appropriated for the construction, operation and maintenance of the transmission system, together with WPA expenditures and net amounts transferred from other Federal agencies, plus interest at the rate of 2½ percent per annum on the unpaid balance.



Bonneville-Grand Coulee 230,000-volt transmission lines top a ridge escarpment as they feed power into BPA's high voltage integrated transmission grid.

As of June 30, 1959, the investment in transmission facilities and expenses amounted to \$667,262,530. Repayments in the amount of \$287,512,125 have been made, leaving an unpaid balance of \$379,750,405. Table III presents a summary of the amount and repayment of the Federal investment in the BPA transmission program. As of June 30, 1959, repayment of the capital investment was \$43,111,077 ahead of schedule.

Comparative Balance Sheet

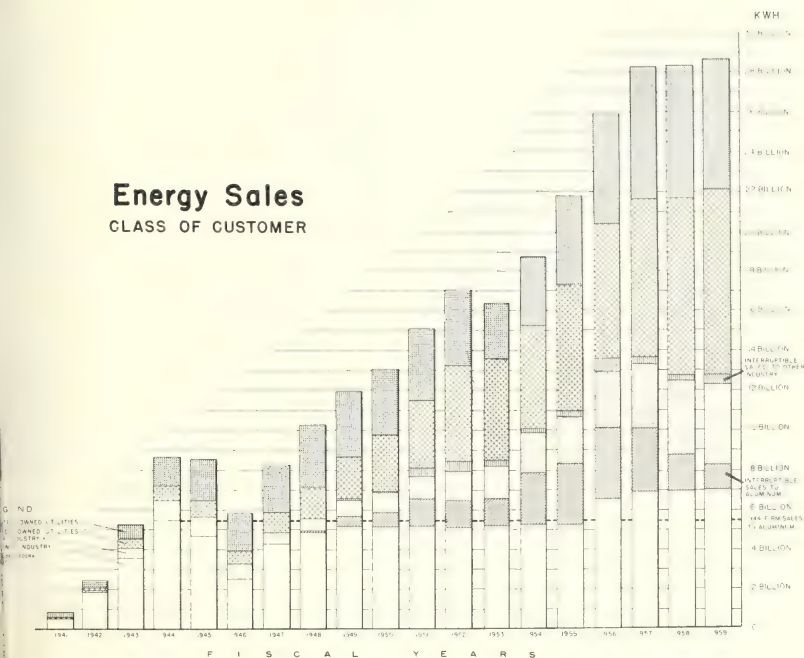
Table IV presents a comparative condensed statement of the assets and liabilities of the Bonneville Power Administration as of June 30, 1958, and 1959.

The June 30, 1959 balance sheet shows accumulative net revenues of \$24,055,474. This surplus is based upon the depreciation on accounting records and is not to be confused with the payout surplus of \$43,111,077 mentioned above and shown in footnote,¹ table II.

The difference of slightly more than \$19 million reflects primarily the difference between provisions for depreciation expense computed on the basis of the straight line depreciation method and scheduled amortization requirements computed on the conventional compound interest method. In the long run the two items will be approximately the same in total, but in the early years of the repayment period

Energy Sales

CLASS OF CUSTOMER



the transmission investment the accumulative amounts of amortization lag behind straight-line basis provisions for depreciation expense.

Comparative Sales Data

Table V presents a statement of the sales of electric energy, both firm and nonfirm, by class of customer for fiscal years 1958 and 1959. In both 1958 and 1959, firm sales continued to rise but non-firm sales decreased, particularly in 1958 compared with 1957.

Specifically, firm sales increased \$2,744,000 and \$3,796,000 in 1959 and 1958, respectively. However, nonfirm sales decreased \$1,098,000 in 1959 and they fell substantially more than that in 1958 relative to 1957. In both 1956 and 1957 nonfirm sales approached \$12 million. Thus, the nonfirm sales of \$6,803,000 in 1959 represent a marked drop from the 1956-7 level.

Sales to the aluminum industry on a firm contractual basis increased slightly in 1959 but this increase was much more than offset by the drop in nonfirm sales for this industry. Sales to other industrial customers on both a firm and nonfirm basis increased by small amounts.

Firm sales to publicly owned utilities increased favorably nonfirm sales to this group were down. However, the latter decrease resulted from the fact that 1958 nonfirm sales to public agencies were unusually high because of difficulties encountered by one local distributor at its own generating plants, thereby requiring the purchase of substantial amounts from the Federal system.

Sales to privately owned utilities decreased on both a firm and nonfirm basis.

The specific amounts of sales to the various customer groups and the increases and decreases are shown in table V.

Operations

Over 30 billion kilowatt-hours of electric energy were generated at the 13 Federal plants for the Bonneville Power Administration during the fiscal year 1959. This was an increase of 0.2 percent over the 1958 fiscal year. The addition of one generating unit at Clifton Joseph and four units at The Dalles and the Roza unit added 38,000 kilowatts to the system giving a total of 5,721,250 kilowatts nameplate rating as of June 30, 1959.

The maximum coincident demand on the 13 Federal plants was 4,737,000 kilowatts, occurring October 7, 5-6 p.m., a 5.7 percent increase from the all-time maximum demand of 5,024,000 kilowatts occurring during the 1958 fiscal year. Energy produced at Federal plants is shown by years in table VI and illustrated in the accompanying chart. Prepared on a quarterly basis, the chart shows the general trends of the Bonneville Power Administration's system output and growth.

Receipts and Deliveries

Bonneville Power Administration's transmission grid forms the backbone of the interconnected transmission system of public and private utilities in the Pacific Northwest. As a result, electric energy receipts and deliveries on Bonneville's transmission system involve many complex transactions in addition to receipts from Federal powerplants and deliveries by sales.

The integrated transmission grid assists in making possible the fullest utilization of power facilities in the area through its diversities in peaking and water capabilities and diversity of system load conditions. Substantial quantities of energy are received and delivered as transfers from other utilities.

TABLE VI.—*Generation at Federal plants for the Bonneville Power Administration, fiscal years 1939–59*

BY FISCAL YEARS

| Fiscal years ending June 30 | Generation (thousands of kilowatt- hours) | Maximum demand (kilowatts) | Load factor (per- cent) |
|-----------------------------|--|----------------------------------|----------------------------------|
| 1939 | 1,144,932 | 210,000 | ..... |
| 1940 | 2,549,153 | 468,000 | 62.2 |
| 1941 | 5,618,436 | 841,000 | 76.3 |
| 1942 | 9,239,823 | 1,355,000 | 77.6 |
| 1943 | 9,051,573 | 1,427,000 | 72.4 |
| 1944 | 6,236,163 | 1,346,000 | 52.9 |
| 1945 | 8,753,737 | 1,335,000 | 74.9 |
| 1946 | 10,885,907 | 1,610,000 | 77.0 |
| 1947 | 12,925,788 | 1,797,000 | 82.1 |
| 1948 | 14,140,834 | 2,106,000 | 76.7 |
| 1949 | 16,472,384 | 2,535,000 | 74.2 |
| 1950 | 18,555,401 | 2,784,000 | 75.9 |
| 1951 | 17,633,232 | 2,867,000 | 70.2 |
| 1952 | 20,195,833 | 3,301,000 | 69.8 |
| 1953 | 23,253,186 | 3,651,000 | 72.7 |
| 1954 | 27,599,380 | 4,479,000 | 70.1 |
| 1955 | 29,984,219 | 4,887,000 | 70.0 |
| 1956 | 30,201,078 | 5,024,000 | 68.6 |
| 1957 | 30,263,824 | 4,737,000 | 72.9 |
| Total | 294,704,883 | 5,024,000 | ..... |

BY PLANTS

| | Generation ¹ (millions of kilowatt-hours) | | Date in serv- ice ² | Operating agency |
|-----------------------------|---|-----------------------------|-----------------------------------|------------------|
| | Fiscal year 1959 | Total to July 1, 1959 | | |
| Falls..... | 231 | 958 | Mar. 25, 1955 | Army Engineers. |
| Giff..... | 89 | 491 | June 12, 1954 | Do. |
| ville..... | 3,510 | 67,459 | June 6, 1938 | Do. |
| ler..... | 66 | 246 | Feb. 13, 1956 | USBR. |
| Joseph ³ | 5,359 | 17,466 | Aug. 20, 1955 | Army Engineers. |
| rt ⁴ | 345 | 2,344 | July 1, 1953 | Do. |
| ..... | 67 | 312 | May 19, 1955 | Do. |
| Coulee ³ | 10,296 | 166,122 | Sept. 28, 1941 | USBR. |
| y Horse..... | 1,012 | 5,661 | Oct. 29, 1952 | Do. |
| it Point ⁴ | 264 | 1,588 | Dec. 16, 1954 | Army Engineers. |
| y..... | 5,588 | 27,381 | Nov. 6, 1953 | Do. |
| ..... | 66 | 66 | Aug. 31, 1958 | USBR. |
| lles..... | 3,371 | 4,611 | May 13, 1957 | Army Engineers. |
| Total..... | 30,264 | 294,705 | | |

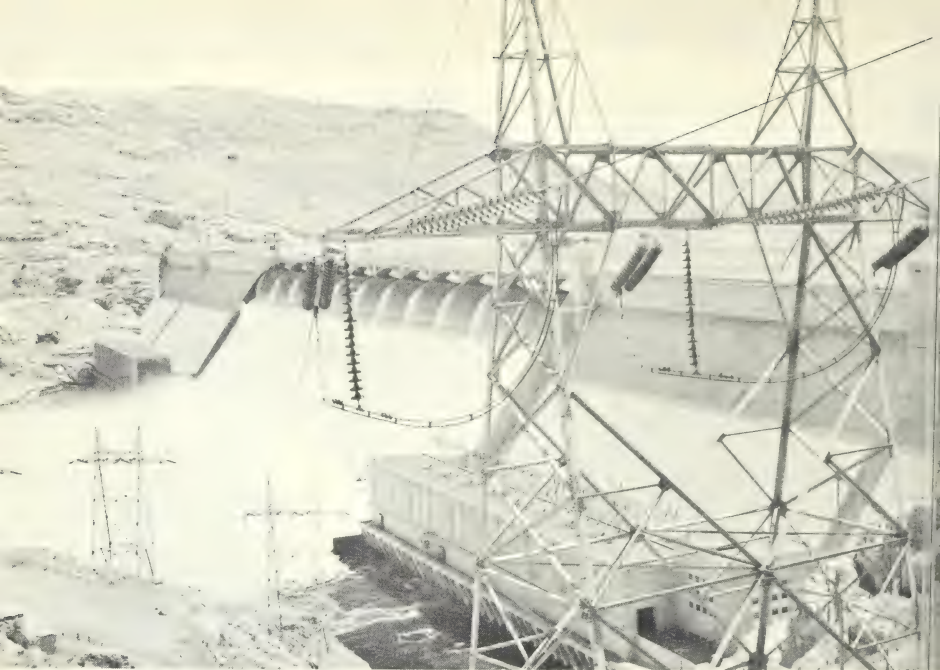
¹ Includes energy generated in testing new generating units.

² Date of commercial operations.

³ Includes energy transferred for Bureau of Reclamation.

⁴ Includes energy for condenser power at Detroit and Lookout Point.

During fiscal year 1959, 9 percent of the energy flowing over BPA was received from other utilities to be delivered either to other plants of the utilities furnishing the energy or to customers of the supplying utility. This percentage has increased rapidly in the last years both in amount of energy and in percentage of total energy of the system.



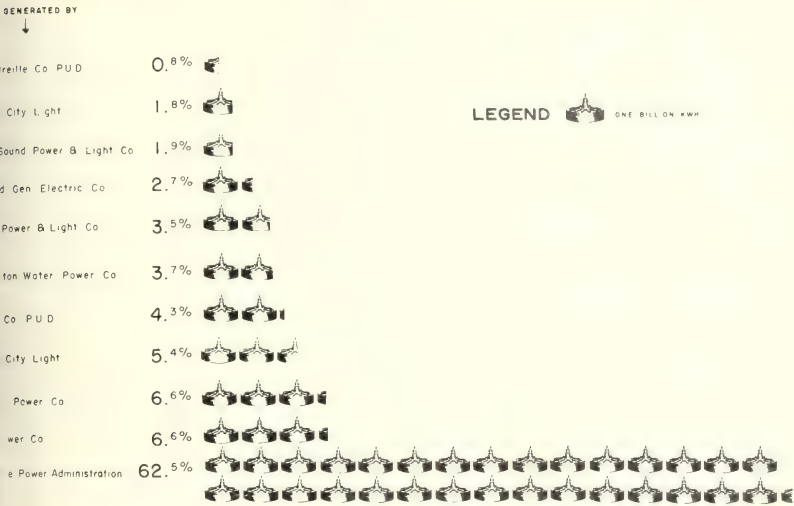
The Grand Coulee Dam supplies more hydroelectric power for the Pacific Northwest than any other project in the U.S. Columbia River power system.

| Fiscal years | Total receipts ¹ (billion kw.-hrs.) | Transfer in (billion kw.-hrs.) ² | Percent of total |
|--------------|--|---|------------------|
| 1955..... | 25.7 | 0.5 | 2.0 |
| 1956..... | 31.1 | 5.8 | 20.0 |
| 1957..... | 34.3 | 1.4 | 4.0 |
| 1958..... | 34.0 | 2.5 | 7.0 |
| 1959..... | 34.3 | 3.1 | 9.0 |

¹ From Federal generation, from other utilities for transfer, and uncontrolled.
² From other utilities for transfer.

In addition to wheeling power from existing non-Federal plants such as Box Canyon, Rock Island, Pelton, and Swift, the BPA has entered into firm contracts for the wheeling of power from Priest Rapids, Rocky Reach, and Wanapum plants now under construction. Transactions summarized in the electric energy account also include storage by BPA in non-Federal reservoirs as well as storage by non-Federal utilities in the Federal reservoirs. Disposition of energy includes deliveries from storage in Federal reservoirs or to storage in reservoirs of other utilities, energy transfers for irrigation purposes for the Department of the Interior's Bureau of Reclamation from Grand Coulee, Chief Joseph, and Roza, energy used by the Bonneville Power Administration, and energy losses in transmission and transformation.

Power Generated BY THE PRINCIPAL ELECTRIC UTILITIES OF THE PACIFIC NORTHWEST
YEAR ENDED JUNE 30, 1959



TOTAL 46.5 BILLION KWH SOURCE WEEKLY OPERATING REPORTS OF N W POWER POOL

THE ABOVE UTILITIES ARE MEMBERS OF THE NORTHWEST POWER POOL EXCEPT FOR CHELAN CO. AND PEND OREILLE PUBLIC UTILITY DISTRICTS. UTAH POWER & LIGHT CO. AND BRITISH COLUMBIA ELECTRIC CO. ARE ALSO POOL MEMBERS BUT ARE NOT INCLUDED IN THIS CHART BECAUSE THEIR MAJOR SERVICE AREAS LIE OUTSIDE THE PACIFIC NORTHWEST REGION.

Table VII, Electric Energy Account, summarizes energy receipts and deliveries for fiscal year 1959.

29 of 29 Billion KWH

Energy sales to customers of the Bonneville Power Administration totaled 28.7 billion kilowatt-hours during the fiscal year 1959, an increase of 1.2 percent over 1958.

Firm energy sales to other utilities increased 4.4 percent in fiscal year 1959 over 1958 and nonfirm sales decreased 16.4 percent. The net increase was 2.2 percent.

Firm energy sales to industries and Federal agencies were greater in 1959 than in 1958 by almost 3 percent, but the nonfirm sales to this group of customers decreased by more than 15 percent. There was no appreciable change in total deliveries.

TABLE VII.—Electric energy account for fiscal year 1958

| | |
|---|--------|
| Energy received (millions of kilowatt-hours) : | |
| Energy generated at Federal plants for BPA ¹ ----- | 30,264 |
| Power interchanged in ----- | 4,050 |
| Total received ----- | 34,314 |

TABLE VII.—*Electric energy account for fiscal year 1958*—Continued

Energy delivered (millions of kilowatt-hours) :

| | |
|---|--------|
| Sales | 28. |
| Power interchanged out | 3. |
| Used by Administration | |
| Total Delivered | 32. |
| Energy losses in transmission and transformation | 1. |
| Losses as percent of total energy received—percent | |
| Maximum demand on generating plants (kilowatts), Oct. 7, 1958 | |
| 5-6 p.m., Pacific Standard Time | 4,737. |
| Load Factor, total generated for BPA, percent | |

¹ For detail by plants, see table VI.*BPA energy sales—fiscal year 1959*

| | Millions of kilowatt-hours | Percent change from 1958 |
|--------------------------------|-------------------------------|-----------------------------|
| Other utilities: | | |
| Publicly owned utilities | 9,356 | |
| Privately owned utilities: | | |
| Firm | 5,553 | |
| Nonfirm | 1,035 | |
| Total | 6,588 | |
| Ultimate consumers: | | |
| Firm | 11,035 | |
| Nonfirm | 1,718 | |
| Total | 12,753 | |
| Total BPA sales: | | |
| Firm | 25,644 | |
| Nonfirm | 3,053 | |
| Total | 28,697 | |

Delivery of interruptible energy to industries reached its lowest level during June-July-August of 1958. By June 1959 deliveries had recovered from a level of 10 percent to almost 50 percent of maximum deliveries made during the 1957 fiscal year.

The completion of new non-Federal hydro resources in the region has accounted for some reduction in deliveries of both firm and nonfirm energy to the privately owned utilities. In addition, sales to the five privately owned utilities starting September 1958 have been on a normal firm power basis of billing since the Bonneville Power Administration could guarantee to supply the utilities' firm power requirements for a period of 4 years. This resulted in a decrease in nonfirm deliveries and an increase in firm power deliveries when compared with sales under the restricted demand basis of billing in effect prior to September 1958. Favorable water conditions in the area throughout the year also reduced the nonfirm energy deliveries. The net effect of these factors was a decrease of less than 0.5 percent in firm sales and a decrease of 8 percent in nonfirm sales to privately owned utilities.

Composite Average Rate of 2.36 Mills

The Bonneville Power Administration has sold 275.7 billion kilowatt-hours of electric energy at a composite rate of 2.36 mills per watt-hour during the 21 years of operation ended June 30, 1959. Sales to publicly owned utilities for the 21 years were 68.2 billion watt-hours at an average of 2.77 mills. Privately owned utilities sold 62.9 billion kilowatt-hours at an average of 2.26 mills, and rate consumers such as industries and Federal establishments sold 144.6 billion kilowatt hours at 2.20 mills.

Power sales to aluminum plants were 112.2 billion kilowatt-hours at an average of 2.10 mills. These plants characteristically take power at very high load factors, approaching 100 percent, which results in the exceptionally low average cost on BPA's C and A rate schedules. Sales to industries other than aluminum, including sales to Federal agencies, were 32.4 billion kilowatt-hours at an average of 2.55 mills.

Energy sales by classes of customers are shown in table VIII.

TABLE VIII.—*Electric energy sales by class of customer, fiscal years 1939-59*

[Millions of kilowatt hours]

| Fiscal years ending June 30 | Industry | | Publicly owned utilities | Privately owned utilities | Total |
|-----------------------------|----------------------|-------------------------------|--------------------------|---------------------------|----------------------|
| | Aluminum | Other industries ¹ | | | |
| 1939 | 523 | 5 | 35 | 537 | 1,100 |
| 1940 | 1,845 | 79 | 143 | 358 | 2,425 |
| 1941 | 3,589 | 507 | 435 | 739 | 5,270 |
| 1942 | 5,454 | 1,022 | 728 | 1,467 | 8,671 |
| 1943 | 4,667 | 965 | 824 | 2,057 | 8,513 |
| 1944 | 2,492 | 800 | 636 | 1,903 | 5,831 |
| 1945 | 4,212 | 627 | 1,045 | 2,378 | 8,262 |
| 1946 | 4,902 | 647 | 1,561 | 3,181 | 10,291 |
| 1947 | 5,666 | 881 | 2,081 | 3,342 | 11,970 |
| 1948 | 5,863 | 1,024 | 2,840 | 3,312 | 13,039 |
| 1949 | 6,545 | 1,538 | 3,414 | 3,579 | 15,076 |
| 1950 | 6,472 | 1,943 | 4,803 | 3,794 | 17,012 |
| 1951 | 6,547 | 1,947 | 5,110 | 2,791 | 16,395 |
| 1952 | ² 7,862 | 2,253 | 5,127 | 3,531 | ² 18,773 |
| 1953 | ² 8,352 | 2,624 | 6,274 | 4,580 | ² 21,830 |
| 1954 | 10,141 | 3,422 | 6,909 | 5,505 | 25,977 |
| 1955 | ² 10,096 | ² 3,581 | 7,970 | 6,565 | ² 28,212 |
| 1956 | ² 8,717 | ² 4,053 | 8,898 | 6,696 | ² 28,364 |
| 1957 | 8,295 | 4,458 | 9,356 | 6,588 | 28,697 |
| Total to July 1, 1959 | ² 112,240 | ² 32,376 | 68,189 | 62,903 | ² 275,708 |

¹ Includes Federal agencies.

² Includes provisional and replaceable energy sales to industries:

| | Aluminum | Other industries |
|--------------|-------------|------------------|
| Fiscal year: | | |
| 1954 | 28,355 mwh | |
| 1955 | 22,956 mwh | |
| 1957 | 323,509 mwh | 27,817 mwh. |
| 1958 | 481,522 mwh | 32,194 mwh. |

Rate Schedules

During the last fiscal year over seven-tenths of the energy were made under the C-4 wholesale rate schedule at an average of 2.12 mills per kilowatt-hour. This is the kilowatt-year rate for firm power delivered anywhere from the transmission system, and also used with special measured demand provisions for sale of interruptible power.

Sales are generally made under this rate to industries operating high load factor and to utilities having substantial generating facilities. Other sales were made principally under the E-4 rate schedule to utilities purchasing all or substantially all of their power requirements from the BPA. At-site power is sold on a kilowatt-year basis under the A-4 rate. Sales under the F-4 schedule were made to utilities and industries requiring power at low load factor use. Sales under the H-schedule for dump, exchange, or experimental purposes. A summary of energy sales for the fiscal year 1959 classified by rate schedules is shown in table IX.

Special study by the staff was continued during fiscal year 1959 on BPA's entire wholesale rate structure and payout. As a result of the study, wholesale rates continuing the present \$17.50 per kilowatt-year level were filed with the Federal Power Commission and become effective commencing December 20, 1959. The Administration has maintained this same rate level since its organization in 1938.

TABLE IX.—*Electric energy sales by rate schedules during fiscal year 1959*

| Rate schedule | Energy (thousands of kilowatt- hours) | Revenue ¹ | M ki tr |
|--|--|----------------------|---------------|
| C-4: | | | |
| Industries | 10, 733, 587 | \$23, 075, 631 | |
| Utilities | 9, 743, 433 | 21, 467, 085 | |
| Subtotal | 20, 477, 020 | 44, 542, 716 | |
| F-4: | | | |
| Industries | 6, 113 | 26, 033 | |
| Utilities | 55, 246 | 256, 854 | |
| Subtotal | 61, 359 | 282, 887 | |
| A-4: | | | |
| Industries | 1, 761, 448 | 3, 018, 447 | |
| Utilities | 12, 269 | 40, 888 | |
| Subtotal | 1, 773, 717 | 3, 059, 335 | |
| E-4: Utilities ² | 4, 949, 690 | 15, 393, 803 | |
| Experimental, H-3 and exchange: Industries and utilities | 1, 434, 717 | 3, 586, 791 | |
| Total | 28, 696, 503 | 66, 865, 532 | |

¹ These revenues from sale of electric energy differ from official accounting records in that billing discounts applicable to only fiscal year 1959 are included.

² Including Federal agency pumping loads.

Customers Served

The Bonneville Power Administration served 114 customers during fiscal year 1959. There were 75 publicly owned distributors

power, 19 industrial customers, 11 Federal agencies, and 9 privately owned utilities.

Generation Added

Additions to the United States Columbia River power system in fiscal year 1959 have a nameplate rating of 387,250 kilowatts. One unit of 64,000 kilowatts was added at Chief Joseph completing the installation of units at this project. Four units with a total rating of 312,000 kilowatts were installed at The Dalles project leaving six units to be installed for the completed project. The U.S. Army Corps of Engineers is the construction agency for both of these projects. In addition, the Roza project of the Department's Bureau of Reclamation containing one generating unit with nameplate rating of 11,250 kilowatts was completed in August 1958.

Projects Summarized

Projects existing, under construction, and authorized for construction by the U.S. Army Corps of Engineers and Department's Bureau of Reclamation are shown in table X. The existing projects, including units installed to date in projects under construction, will provide 4,440,000 kilowatts of prime power when operated as a system. With completion of the projects under construction the prime capability will be 5,395,000 kilowatts and with completion of the authorized projects prime capability will be over 6,000,000 kilowatts.

Our 230,000 volt transmission lines carry power from McNary Dam powerhouse generators to the McNary switchyard from where it is transmitted to Pacific Northwest load centers.



TABLE X.—*U.S. Columbia River power system, general specifications, projects existing, under construction and authorized installations and capabilities correspond to a coordinated system operation, June 30, 1959*

| Project | Location | Stream | Plant installations | | Nominal prime power kilowatts ² | Pool elevation (feet) | Usable storage (acre-feet) ³ | Average head (feet) | Date in service | | Principal purposes ⁴ |
|--------------------|--------------------|-----------------------------|---------------------|---------------------------------------|--|-----------------------|---|---------------------|---------------------|---------------------|---------------------------------|
| | | | Number of units | Total capacity kilowatts ¹ | | | | | Initial unit | Last unit | |
| Existing: | | | | | | | | | | | |
| Bonneville..... | Washington-Oregon. | Columbia..... | 10 | 518, 400 | 466, 000 | 74 | Pondage | 58 | June 1938..... | December 1943..... | P, N. |
| Grand Coulee..... | Washington..... | do..... | 18 | 1, 944, 000 | 1, 552, 000 | 1, 288 | 5, 072, 000 | 315 | September 1941..... | September 1951..... | P, I, FC, N, PS. |
| Hungry Horse..... | Montana..... | South Fork Flathead..... | 4 | 285, 000 | 186, 000 | 3, 560 | 2, 982, 000 | 376 | October 1952..... | July 1953..... | P, I, FC, N, PS. |
| Detroit..... | Oregon..... | North Santiam..... | 2 | 100, 000 | 39, 000 | 1, 563. 5 | 323, 000 | 285 | July 1953..... | October 1953..... | P, I, FC, N, PS. |
| McNary..... | Washington-Oregon. | Columbia..... | 14 | 980, 000 | 527, 000 | 340 | Pondage | 75 | November 1953..... | February 1957..... | P, I, N. |
| Big Cliff..... | Oregon..... | North Santiam..... | 1 | 18, 000 | 11, 000 | 1, 206 | Pondage | 91 | June 1954..... | June 1954..... | P, Rereg. |
| Lookout Point..... | do..... | Middle Fork Willamette..... | 3 | 120, 000 | 34, 000 | 926 | 336, 500 | 185 | December 1954..... | April 1955..... | P, I, FC, N, PS. |
| Albeni Falls..... | Idaho..... | Pend Oreille..... | 3 | 42, 600 | 21, 000 | 2, 062. 5 | 1, 155, 000 | 18 | March 1955..... | August 1955..... | P, FC, N, PS. |
| Dexter..... | Oregon..... | Middle Fork Willamette..... | 1 | 15, 000 | 11, 000 | 695 | Pondage | 53 | May 1955..... | May 1955..... | P, Rereg. |
| Chief Joseph..... | Washington..... | Columbia..... | 16 | 1, 024, 000 | 856, 000 | 946 | Pondage | 177 | August 1955..... | September 1958..... | P, I. |
| Chandler..... | do..... | Yakima..... | 2 | 12, 000 | 11, 000 | 618. 5 | ----- | 118 | February 1956..... | February 1956..... | P, I. |
| The Dalles..... | Washington-Oregon. | Columbia..... | 10 | 651, 000 | 624, 000 | 160 | Pondage | 84 | May 1957..... | April 1959..... | P, N. |
| Roza..... | Washington..... | Yakima..... | 1 | 11, 250 | 6, 000 | 1, 220. 6 | ----- | 140 | August 1958..... | August 1958..... | P, I. |
| | | | | 5, 721, 250 | 4, 344, 000 | ----- | 9, 868, 500 | | | | |

Under construction

| | Washington-Oregon | Columbia | 6 | 468,000 | 50,000 | 160 | Pondage | 84 | August 1959 | November 1960 | P, N. |
|------------------------|-------------------|----------------|----|-----------|-----------|-------|------------|-----|---------------|---------------|------------------|
| The Dalles (Additions) | Washington-Oregon | Middle Fork | 2 | 30,000 | 16,000 | 1,543 | 249,000 | 210 | November 1961 | November 1961 | P, I, FC, N, PS. |
| Hills Creek | Washington-Oregon | Snake | 3 | 270,000 | 171,000 | 440 | Pondage | 95 | December 1961 | December 1961 | P, I, N. |
| Ice Harbor | Washington-Oregon | South Fork | 2 | 25,000 | 17,000 | 1,690 | 154,000 | 350 | November 1962 | November 1962 | P, FC, N, PS. |
| Cougar | Washington-Oregon | McKenzie | 12 | 1,304,400 | 797,000 | 265 | Pondage | 104 | June 1967 | February 1969 | P, I, FC, N. |
| John Day | Washington-Oregon | Columbia | | | | | | | | | |
| | | | | 2,097,400 | 1,051,000 | | 403,000 | | | | |
| Authorized: | Montana | Kootenai | 4 | 344,000 | 257,000 | 2,459 | 5,010,000 | 265 | | | P, FC, N, PS. |
| Libby | Washington | Snake | 3 | 270,000 | 169,000 | 533 | Pondage | 92 | | | P, I, N. |
| Lower Monumental | do | do | 3 | 270,000 | 180,000 | 633 | Pondage | 99 | | | P, N. |
| Little Goose | do | do | 3 | 300,000 | 184,000 | 735 | Pondage | 100 | | | P, N. |
| Lower Granite | Oregon | Middle Santiam | 2 | 81,000 | 22,000 | 984 | 333,000 | 250 | | | P, I, FC, N, PS. |
| Green Peter | do | do | 1 | 15,000 | 9,000 | 670 | Pondage | 90 | | | P, Rereg. |
| White Bridge | | | | 1,280,000 | 821,000 | | 5,343,000 | | | | |
| | | | | | 5—31,000 | | | | | | |
| Total, 23 projects. | | | | 9,098,650 | 6,185,000 | | 15,614,500 | | | | |

¹ Nameplate rating.² Average capability in a coordinated system during an 8-month storage release period (September 1936 through April 1937).³ Storage usable for power production.⁴ P—Power; I—Irrigation; FC—Flood

Storage; Rereg.—Reregulating Reservoir.

Control; N—Navigation; PS—Power

⁵ Pumping requirements of 31,000 kw. represents the average power necessary to supply that part of irrigation water at Grand Coulee during the storage release period for 600,000 acres of the Columbia Basin project.

BPA—Branch of System Operations and Power Resources June 30, 1959.



A steel tower carrying one of the Bonneville Power Administration Columbia-Covington 230,000-volt transmission lines marks the base of the summit of the Cascade range at Stampede Pass enroute from Grand Coulee to Puget Sound and northwest Washington load centers.

Existing storage capacity usable for power in Federal reservoirs is 9,868,500 acre-feet. An additional 403,000 acre-feet will be provided by Cougar and Hills Creek on which construction is under way, and 5,343,000 acre-feet would be provided by Libby and Green Gate projects which are authorized for construction.

All generation and storage capacity under Federal construction will be in service by February 1969 under the present schedule. Service dates for the other authorized projects are not scheduled and no funds have been appropriated for their construction.

Non-Federal Additions

Non-Federal generating capacity in the area served by the BPA was increased in fiscal year 1959 by a total of 376,600 kilowatts. Principal additions include Pacific Power & Light's completed Swift No. 1 project which contains three generating units with a total nameplate rating of 204,000 kilowatts and Cowlitz County Irrigation Utility District's completed Swift No. 2 project containing two generating units with a total nameplate rating of 70,000 kilowatts.

ther additions include installation of an additional 45,000 kilowatt unit at Pacific Power & Light's Merwin project, two units of 19,200 kilowatts each installed at Portland General Electric's completed North Fork project and installation of an additional 19,200 kilowatt unit at Portland General Electric's Faraday plant. Future additions under construction or licensed for construction by non-Federal utilities in the area are shown in table XI. These additions total 3,355,550 kilowatts as compared to additions of 3,445,250 kilowatts scheduled for next year. The reduction of 94,700 kilowatts results principally from completion of certain scheduled projects.

Northwest Power Pool

Generation by the principal electric utility systems of the Pacific Northwest during the fiscal year 1959 is shown in table XII. All utilities listed are members of the Northwest Power Pool with the exception of the Chelan County and Pend Oreille County Public Utility Districts. These two utilities are included because they produced substantial amounts of generation to the pool. The Utah Power & Light Co. and the British Columbia Electric Co. are members of the pool but are not included as their major service areas are outside the region.

A total of 62.5 percent of the energy generated by the major utilities of the region was produced by the United States Columbia River power system. In addition to its other load the Bonneville Power Administration's transmission system delivered 9.1 billion kilowatt-hours of energy to meet the net requirements of eight other pool utilities.

Transmission System Growth

The Bonneville Power Administration grid was increased during the fiscal year to 7,936 circuit miles of transmission lines and 193 substations, totaling 14,004,955 kilovolt-amperes transformer capacity.

During the year, the transmission line mileage was increased 255 circuit miles, and the transformer capacity by 1,304,707 kilovolt-amperes. A total of 9 new substations, ranging in size from 6,000 to 50,000 kilovolt-amperes, were installed and the transformer capacity was increased in 18 others.

Construction Program

Major grid additions completed in Oregon included a 230,000-volt line between Santiam and Eugene and a 250,000 kilovolt-ampere sub-

station at Fairview (near Coquille) to supply the additional power needs of this rapidly growing area. In western Washington 115,000-volt lines were added between Olympia and Aberdeen, Shelton Fairmount, and Raymond and Willapa. To meet the rapid growth of the Columbia reclamation area in Washington a 250,000 kilowatt ampere substation was added at Potholes (near Moses Lake), a 115,000-volt line between Columbia (near Wenatchee) and Quincy, a 115,000-volt line between Potholes and Sand Dunes (near Moses Lake). Added service to the Northwestern Montana area was established through completion of the 115,000-volt Columbia Falls-Triana line.

TABLE XI.—*Non-Federal utilities generator installation schedule, 1955-1959*

| Utility and plant | Stream | Unit | Nameplate rating (thousands of kilowatts) | Date in service |
|--|----------------|--|--|---|
| Washington Water Power Co.: Noxon Rapids | Clark Fork | 1 2 3 4 | 84 84 84 84 | August 1955 November 1955 January 1956 April 1956 |
| Puget Sound Power & Light Co.: Upper Baker | Baker River | 1 and 2 | 85 | August 1956 |
| Lower Baker (addition) | Baker River | 3 | 55 | September 1956 |
| Grant County PUD: Priest Rapids | Columbia River | 1 2 3 4 5 6 7 8 9 10 | 178.85 178.85 78.85 78.85 78.85 78.85 78.85 78.85 78.85 78.85 | November 1955 December 1955 February 1956 April 1956 June 1956 August 1956 October 1956 February 1957 April 1957 June 1957 |
| Wanapum | Columbia River | 1 and 2 3 4 5 6 7 8 9 10 | 166.2 83.1 83.1 83.1 83.1 83.1 83.1 83.1 83.1 | September 1956 November 1956 January 1957 March 1957 May 1957 July 1957 September 1957 November 1957 January 1958 |
| City of Seattle: Gorge (reconstruction). | Skagit River | | (2) | December 1957 |
| Montana Power Co.: Thompson Falls (additions). | Clark Fork | 7 and 8 | 35 | April 1958 |
| Chelan County PUD: Rocky Reach | Columbia River | 1 2 3 4 5 6 7 | 101.65 101.65 101.65 101.65 101.65 101.65 101.65 | August 1958 September 1958 September 1958 December 1958 February 1959 April 1959 June 1959 |
| City of Tacoma: Mayfield | Cowlitz River | 1 2 3 4 | 40 40 40 40 | September 1958 December 1958 March 1959 June 1959 |
| Mossyrock | Cowlitz River | 1 2 3 4 | 75 75 75 75 | April 1959 July 1959 October 1959 December 1959 |
| City of Eugene: Carmen | McKenzie River | 1 and 2 | 47.5 | September 1959 |
| Trail Bridge | McKenzie River | 1 | 6 | September 1959 |

¹ Operation at reduced head through January 1960 will reduce capacity to about 47,000 kilowatts.

² Reconstruction of diversion dam will increase gross head by 100 feet and peaking capability to 137,000 kilowatts.

TABLE XII.—*Generation by the principal electric utility systems of the Pacific Northwest, fiscal year 1959*¹

| Utilities | Kilowatt-hours (billion) | Percent of total generation |
|--|-----------------------------|-----------------------------------|
| Publicly owned: | | |
| U.S. Columbia River power system | 30.3 | 62.5 |
| Chelan County PUD | 2.1 | 4.3 |
| Seattle City Light | 2.6 | 5.4 |
| Tacoma City Light | .9 | 1.8 |
| Pend Oreille County PUD | .4 | .8 |
| Total publicly owned | 36.3 | 74.8 |
| Privately owned: | | |
| Montana Power Co. | 3.2 | 6.6 |
| Idaho Power Co. | 3.2 | 6.6 |
| Washington Water Power Co. | 1.9 | 3.9 |
| Pacific Power & Light Co. | 1.7 | 3.5 |
| Puget Sound Power & Light Co. | .9 | 1.9 |
| Portland General Electric Co. | 1.3 | 2.7 |
| Total privately owned | 12.2 | 25.2 |
| Total generation | 48.5 | 100.0 |

Generation shown is for members of the Northwest Power Pool plus Chelan County and Pend Oreille County Public Utility Districts. Utah Power & Light Co. and British Columbia Electric Company are members of the Power Pool but are not included because their service areas lie outside the Pacific Northwest region.

Under construction at the close of this fiscal year is a 345,000-volt, 8-mile line from Chelan County Public Utility District's Rocky Reach hydroelectric project to Maple Valley (near Seattle) to bring the output of the project to western Washington; a 125-mile, 287,000-volt line between Tacoma and Columbia which will be connected to Grand Coulee line No. 3 at Columbia; and a 40-mile, 115,000-volt line from Albany to Toledo, Oreg.

Major new starts scheduled for fiscal year 1960 include an 81-mile, 345,000-volt line (230,000 volt operation) between Big Eddy (near Dalles Dam) and McLoughlin (near Oregon City and owned by Portland General Electric Co.) to supply the load growth in the northern Willamette Valley; a 40-mile, 115,000-volt line between Moss and Fossil and a 130-mile, 115,000-volt line between Redmond and Burns to bring direct service to these central Oregon areas.



A construction worker erects a steel tower on one of BPA's high voltage transmission lines against a background of the Bonneville Dam spillway.

Southwestern Power Administration

Douglas G. Wright, *Administrator*



FOR THE FISCAL YEAR 1959, Southwestern Power Administration of the Department of the Interior received \$1,031,250 by direct appropriation for its operation and maintenance program. Authorization by the Congress made \$4,405,000 available out of receipts to cover all costs in connection with the purchase of power and energy and the rental of transmission facilities. There was no new construction appropriation in fiscal year 1959, but funds in the amount of \$209,681 remained available for completion of previously approved construction programs.

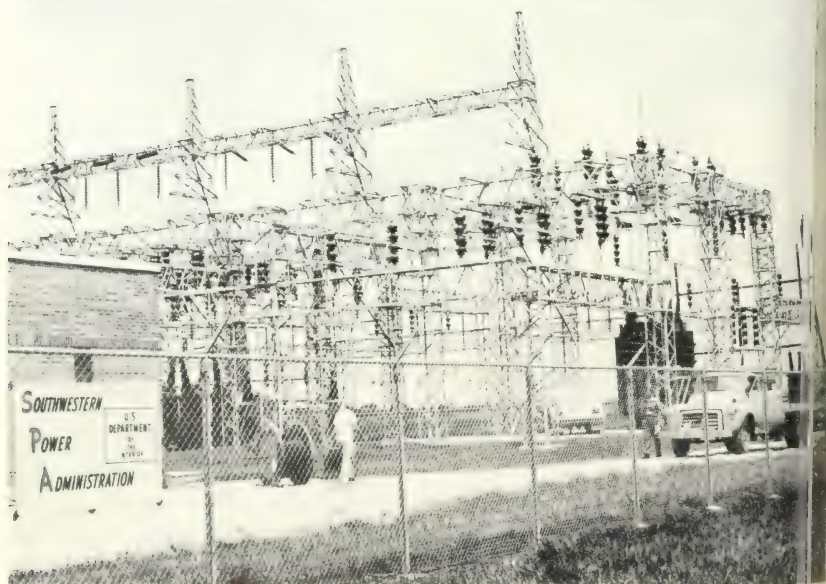
Power Resources

The installed generating capacity and capability in the hydroelectric and steam electric plants in the integrated system as of June 30, 1959, are shown in the following page.

With the completion of the installation and testing of the first two units at the Table Rock project in May, 1959, the installed capacity of the interconnected system was increased to 601,000 kilowatts. The power pool at Table Rock has not filled, but the project has been placed in limited commercial operation to utilize the water released for downstream requirements for power generation. By December 30, 1961, an additional 190,000 kilowatts of installed capacity will be available upon completion of the final 100,000 kilowatts at Table Rock and the addition of 90,000 kilowatts at Bull Shoals.

By the time the ultimate installation at Table Rock is available, 40 miles of 154-kilovolt line from the project to Springfield will complete the interconnection with the grid.

| Project or plant | State | River basin | Installed capacity | Dependable capacity | Capacity June 19 |
|-------------------------------------|---------------------|----------------------|--------------------|---------------------|-------------------|
| Hydroelectric: | | | <i>Kilo-watts</i> | <i>Kilo-watts</i> | <i>Kilo-watts</i> |
| Interconnected system: | | | | | |
| Bull Shoals..... | Arkansas..... | White..... | 160,000 | 100,000 | 180,000 |
| Denison..... | Oklahoma-Texas..... | Red..... | 70,000 | 54,000 | 80,000 |
| Fort Gibson..... | Oklahoma..... | Grand..... | 45,000 | 45,000 | 60,000 |
| Norfork..... | Arkansas..... | White..... | 70,000 | 56,000 | 80,000 |
| Table Rock..... | Missouri..... | do..... | 100,000 | 69,000 | 130,000 |
| Tenkiller Ferry..... | Oklahoma..... | Illinois..... | 34,000 | 28,000 | 40,000 |
| Subtotal..... | | | 479,000 | 352,000 | 540,000 |
| Isolated plants: | | | | | |
| Blakely Mountain..... | Arkansas..... | Ouachita (Red)..... | 75,000 | 75,000 | 100,000 |
| Narrows..... | do..... | Little Missouri..... | 17,000 | 14,000 | 20,000 |
| Whitney..... | Texas..... | Brazos..... | 30,000 | 24,000 | 40,000 |
| Subtotal..... | | | 122,000 | 113,000 | 160,000 |
| Total hydroelectric..... | | | 601,000 | 465,000 | 700,000 |
| Steam: | | | | | |
| Central Electric Power Co-op..... | | | 15,000 | 16,000 | 20,000 |
| N.W. Electric Power Co-op, Inc..... | | | 40,000 | 42,000 | 50,000 |
| Western Farmers Electric Co-op..... | | | 30,000 | 30,000 | 40,000 |
| Total steam..... | | | 85,000 | 88,000 | 110,000 |
| Grand total..... | | | 686,000 | 553,000 | 810,000 |



Clinton, Mo. substation is Southwestern Power Administration's northern hub for interchange of power requirements.

Energy Production

Reservoir inflow for the first 5 months of the fiscal year was exceptionally high. Since December 1, 1958, the flow has been low normal and low reservoir levels have reflected this condition. The reservoir system storage was approximately 90 percent full (not including Table Rock reservoir) at the end of the fiscal year. Table Rock, which has been filling since December 1, 1958, has filled its dead storage pool and approximately 10 percent of its live pool. Inflow data for the various projects are shown below:

| Project and State | Stream | Percent of median flow | | |
|---------------------------------|----------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| | | July 1, 1958 to Nov. 30, 1958 | Dec. 1, 1958 to June 30, 1959 | July 1, 1958 to June 30, 1959 |
| Blakely Mountain, Arkansas..... | Ouachita..... | 354 | 94 | 122 |
| Bull Shoals, Arkansas..... | White..... | 343 | 74 | 110 |
| Denison, Oklahoma-Texas..... | Red..... | 526 | 68 | 64 |
| Fort Gibson, Oklahoma..... | Grand..... | 345 | 58 | 132 |
| Norfolk, Arkansas..... | Little Missouri..... | 278 | 93 | 110 |
| Table Rock, Arkansas..... | North Fork..... | 285 | 80 | 125 |
| Tenkiller Ferry, Missouri..... | White..... | 370 | 72 | 113 |
| Tenkiller Ferry, Oklahoma..... | Illinois..... | 298 | 93 | 131 |
| Whitney, Texas..... | Brazos..... | 170 | 51 | 93 |
| Whitney system average..... | | 257 | 71 | 109 |

The net generation for the 1959 fiscal year for each project is given in the following tabulation. The total net hydroelectric generation amounted to 1,323,107,420 kilowatt-hours of which 1,084,495,200 kilowatt-hours were from the interconnected system.

| Project: | <i>Net generation fiscal year 1959 (kilowatt-hours)</i> |
|-------------------------------|---|
| Interconnected system: | |
| Bull Shoals | 488,146,000 |
| Denison | 109,352,000 |
| Fort Gibson | 161,297,700 |
| Norfolk | 208,768,800 |
| Table Rock | ¹ 10,220,000 |
| Tenkiller Ferry | 106,710,700 |
| Subtotal | 1,084,495,200 |
| Isolated plants: | |
| Blakely Mountain | 175,753,000 |
| Narrows | 25,181,220 |
| Whitney | 37,678,000 |
| Subtotal | 238,612,220 |
| Total hydroelectric | 1,323,107,420 |

¹ Table Rock project considered in limited commercial operation, June 1, 1959, utilizing power generation the water released for downstream interests.



Massive steel towers carry the 154-kilovolt transmission line out of the White River Basin north from the Table Rock Dam to Springfield, Mo.

Steam Plants

The amounts of energy generated by these plants for marketing during fiscal year 1959 are shown in the following table:

| | <i>Net generation fiscal year 1959 (kilowatt-hours)</i> |
|--|---|
| Central Electric Power Co-op (Chamois, Mo.) ----- | 103,794,000 |
| N.W. Electric Power Co-op (Missouri City, Mo.) ----- | 269,071,000 |
| Western Farmers Electric Co-op (Anadarko, Okla.) ----- | 214,622,000 |
| Total steam ----- | 587,487,000 |

Marketing

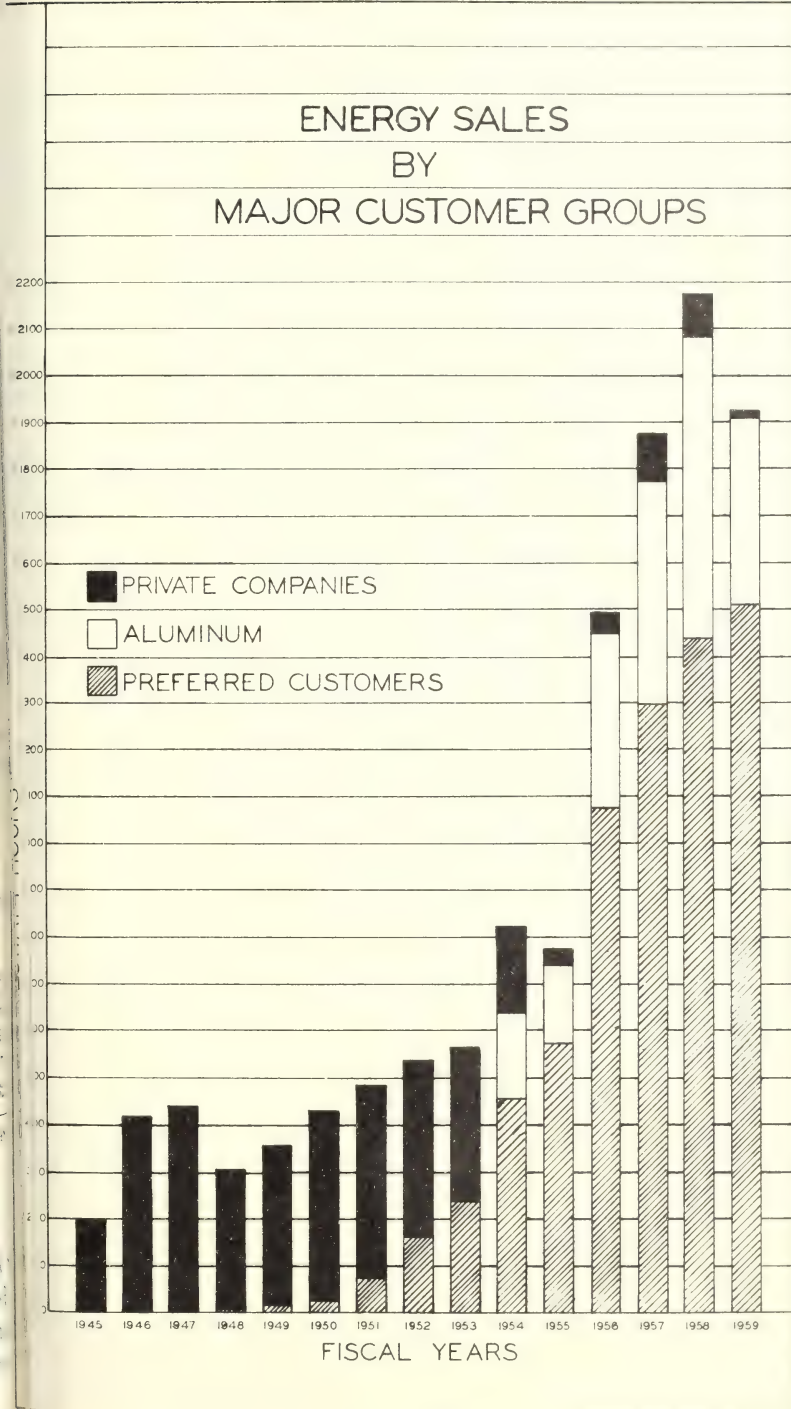
During the 1959 fiscal year, the electric power utilized by the Southwestern Power Administration was obtained and disposed of as follows: 1,323.1 million kilowatt-hours generated at Federal multiple purpose projects, 701.8 million kilowatt-hours obtained from private

ENERGY SALES BY MAJOR CUSTOMER GROUPS

PRIVATE COMPANIES
ALUMINUM
PREFERRED CUSTOMERS

1945 1946 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959

FISCAL YEARS



mal-electric generation by others, for a total of 2,024.9 million kilowatt-hours. A total of 1,834.3 million kilowatt-hours (90.6 percent) was marketed as firm energy, while 89.5 million kilowatt-hours (4.4 percent) was marketed as secondary energy, with a total of 1.6 million kilowatt-hours (0.8 percent) as system losses.

It is noteworthy that deliveries to preferred customers amounted to 1,510.2 million kilowatt-hours, the equivalent of 74.6 percent of the hydroelectric energy available. Revenues from sales amounted to \$14,529,241.

The attached graph shows the yearly distribution of the sales among preferred customers, the Reynolds Metals Co. (aluminum refining), and the private utility companies. It portrays the growth and achievement of Southwestern Power Administration in supplying increased amounts of power to preferred customers.

During the 1959 fiscal year contract obligations were increased to 22,740 kilowatts. Twenty-four new delivery points were added and nine were abandoned. Service to the Naval Air Technical Training Center at Norman, Okla., was terminated upon deactivation of that base.

At the end of the 1959 fiscal year the power commitments to preferred customers were as follows:

| | |
|--|-----------|
| | Kilowatts |
| Distribution and G & T Cooperatives, 20 ¹ ----- | 259,000 |
| Municipalities, 23 ----- | 53,000 |
| Military Installations, 4 ----- | 10,000 |
| Total ----- | 322,000 |

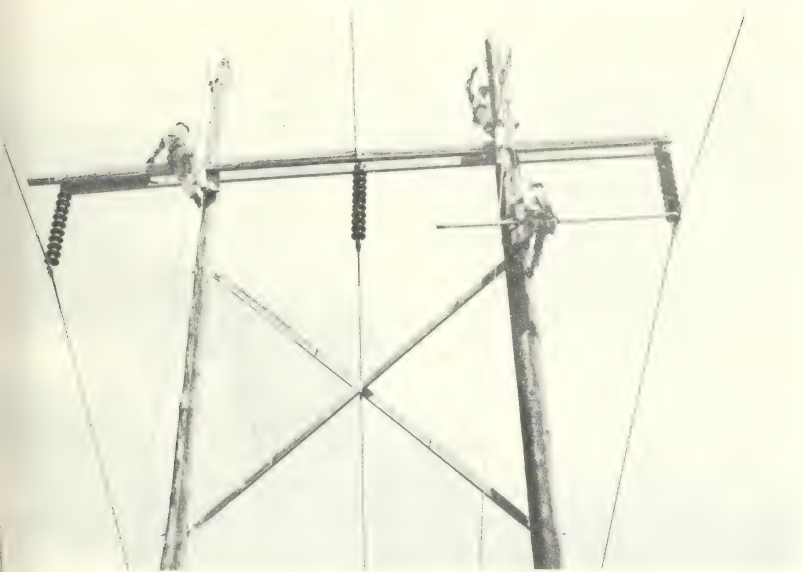
¹ Four distribution cooperatives formerly supplied by the Government through Texas Power & Light Co. joined the Tex-La Cooperative.

Contracting

A contract was consummated with one new preferred customer, the City of Blackwell, Okla., for 1,000-kilowatt capacity to supplement that supplied by the City's steam generating plant.

The integration of systems in the Southwest was advanced in the fiscal year 1959 as the result of two interconnections between the Southwestern Farmers Electric Cooperative and the Oklahoma Gas & Electric Co. which serve to strengthen both systems. There is no sale of power between the parties. The accounting for the flow of power is accomplished through existing contracts of the Government with each party.

Eight electric distribution cooperatives in Texas, including seven cooperatives formerly supplied by the Government through Texas Power & Light Co. facilities, gained the advantages attending



aintenance crews of Southwestern Power Administration have a year and battle with the elements of nature such as shown here in the handling of a "live" 154-kilovolt line with a "hot-stick" in the replacement of a 65-foot pole on the 154-kilovolt grid.

members of G & T cooperatives by forming the Tex-La Electric Cooperative. Power for Tex-La is supplied by the Government through the Texas Power & Light Co. facilities.

A new contract was consummated with the M & A Electric Power Cooperative. This new contract provides more complete integration of power from M & A's diesel generating plant with the Government's hydroelectric power.

A contract was consummated with the Kansas City Power & Light Co. whereby the company will purchase from the Government 75,000 kilowatts of peaking power, any part of which may be reclaimed by the Government for service of preferred customers, on 4 years' advance notice. It also provides an additional market for interruptible capacity and dump energy, and provides for limited conservation of water by allowing the Federal Government to take off-peak energy from the company during low water periods and return energy to the company during periods of adequate stream flow. It further provides that in the event the Government desires to serve a customer in the service area of the company, the Government will first negotiate with the company to supply such service for the

account of the Government, before other service arrangements are made.

Additional contracts are being negotiated for the sale of peaking power to private utility companies on a reclaimable basis. Studies are in progress to permit more complete integration of the Government's hydroelectric facilities with the companies to assist in serving preference customers, and with those customers of the Government having generating plants.

Southwest Field Committee

Southwestern Power Administration continued to participate in the general coordination activities of the Southwest Field Committee of the Department.

Accelerated upstream conservation programs, coupled with construction on main stem projects, have emphasized the continuing value of close field level association among agencies of the Department of the Interior, and also have pointed up the value of exchange of program information at regular meetings and in preparation of the Regional Program Report.

Arkansas-White-Red Basins Interagency Committee

Southwestern Power Administration participated in all meetings of the Arkansas-White-Red Basins Interagency Committee during fiscal year 1959.

New construction on the Arkansas River and tributaries, with problems incident thereto, stresses the continued responsibility of the coordinating agency to assure sound use of our natural resources.

The Federal Power Commission, as Chairman Agency for 1960, has been informed of the Department's interest in the development and conservation of all natural resources with special recognition being given to future high priority uses of water, reallocation of storage, and pump-back installations in connection with hydroelectric generating facilities.

At the January 1960 meeting of AWRBIAC, Southwestern Power Administration, with other power supply and distribution sources, is scheduled to present a comprehensive program on current power production and marketing procedures relating to the integrated systems of the area.

Litigation

The following litigation was closed during the fiscal year of 1959:

Civil Action 362-57, Allis-Chalmers Manufacturing Company v. United States, filed August 1, 1957.

Civil Action 129-58, Guthrie Electrical Construction Co. v. United States of America.

Civil Action 361, United States v. 150.53 acres of land in Benton County, Arkansas, D. L. Nichols, et al., and unknown owners.

Civil Action 4425, United States v. 1.3 acres of land, more or less (situated in Johnston County, Oklahoma), Guy Shelby et al., and unknown owners.

Civil Actions filed and continued are as follows:

Civil Action 1046, United States v. 54 Tracts of Land in Greene County, Missouri, and John P. Kreider, et al., pending in the United States District Court for the Western District of Missouri, Southern Division, involves \$250 deposited therein for condemnation of a transmission line right-of-way across a tract of land (tract 36 (3303-32)) in which an individual owns a life estate and minor children own remainder interests.

Civil Action 5972, United States v. Lands in Polk County, Texas, N. C. Edens, et al., pending in the United States District Court for the Southern District of Texas, Houston Division, involves \$20 deposited therein for condemnation of a transmission line right of way across a tract of land (tract 18 (3306-18)) included in an estate which has not been probated.

Civil Action 1387, United States v. 24.03 acres of land in McDonald County, Missouri, J. E. Wilson, et al., and unknown owners, filed September 18, 1957, in the United States District Court for the Southern District of Missouri, Southern Division, involved \$1,210 deposited therein for condemnation of transmission line rights of way across five tracts of land. Case pending as to one tract.

Southeastern Power Administration

Chas. W. Leavy, *Administrator*



DURING FISCAL YEAR 1959 Southeastern Power Administration of the Department of the Interior marketed 1,186,000 kilowatts of capacity (with peak generation of 1,411,720 kilowatts) and 2,330,086 kilowatt-hours of energy. It was sold to 52 public bodies, 74 rural electric cooperatives, 1 Federal agency, and 6 privately owned utilities.

Sales during the year earned \$14,863,863.87, as compared to \$19,006,631.67 for the previous year, bringing the revenue earned in all years to total \$90,681,192.68. The decline in revenues earned was due to generally poorer than average water conditions.

The output was generated at 10 U.S. Army Corps of Engineers projects. They were the Wolf Creek, Dale Hollow, Center Hill, and Old Hickory projects in Kentucky and Tennessee, the Allatoona and Buford projects in Georgia, the Clark Hill project in Georgia and South Carolina, the Jim Woodruff project in Florida, the John H. Kerr and Philpott projects in Virginia.

The installed generating capacity of 1,259,600 kilowatts includes a 12,000-kilowatt unit installed but not in operation at Cheatham project in Tennessee. Construction by the Corps of Engineers continued on Cheatham as well as three other projects (Walter F. George in Georgia and Alabama, Hartwell in Georgia and South Carolina, and Barkley in Kentucky). The construction under way will add 548,000 kilowatts of installed capacity.

Distribution of Sales

The combined output of Wolf Creek, Center Hill, and Dale Hollow projects continued to be sold to the Tennessee Valley Authority.

der a long-term contract. The entire output of the Old Hickory project and the anticipated output of the first unit at Cheatham was sold under another long-term contract with the Authority. All the Philpott project output was sold to Appalachian Power, under temporary arrangements pending the conclusion of negotiations for long-term sale.

Two-thirds of the Kerr project's output continued to be sold under long-term contracts to the Virginia Electric and Power Co., and to cooperatives in Virginia and North Carolina and the remainder continued to be sold under long-term contracts to Carolina Power & Light Co. and to 16 public bodies and cooperatives in North Carolina.

Part of the Clark Hill project output was sold under long-term contracts to two public bodies in South Carolina. The one-half the output of the Clark Hill project to be marketed in Georgia and the entire output of the Allatoona and Buford projects were sold under long-term contracts to Georgia Power Co. and 86 public bodies and cooperatives in Georgia. The output of the Jim Woodruff project was sold under long-term contracts to Florida Power Corp. and 6 public bodies and cooperatives in Florida.

The Congress appropriated for the fiscal year \$235,000 for headquarters operation and maintenance, and \$500,000 for the purchase of firming energy and the payment of wheeling fees. Southeastern's working force numbered 36 employees at the beginning of the fiscal year and 33 employees when the year ended.

Defense Electric Power Functions



THE ASSISTANT SECRETARY is responsible for carrying out the nonmilitary mobilization functions of the Secretary of the Interior with respect to electric power. Activities are concerned with the development and maintenance of plans to insure the continuity of adequate electric service under partial or full mobilization conditions.

Progress has been made with respect to a field organization to handle directly certain types of immediate post-attack problems such as an emergency service for human survival and early restoration of essential power facilities. To assure that electric service will be available where most needed during such a period, reliance is placed on a field organization. Sixteen power areas have been established. These areas compare with the pool areas within which groups of interconnected utilities operate. Heading each area will be a director, with a deputy, an alternate, and a power utilization consultant. Of the 64 persons required to head the field organization, 50 percent have been appointed. As qualified persons are selected and security clearances obtained, further appointments will be made.

An Emergency Operations Handbook has been completed in draft form. It sets forth the plan of organization and operating guidelines for a Defense Electric Power Administration under conditions of a national emergency. These items are outlined to the extent that presently can be anticipated. The handbook contains information as to the Department of the Interior's responsibilities, organization charts with individual responsibilities and functions clearly outlined, suggested necessary preattack actions to get ready to stay ready, and procedures to be followed after an attack. The handbook has had preliminary distribution for comments and criticisms. After revision it will be distributed to electric utilities and affected governmental agencies.

A program has been effected to train electric power industry personnel as instructors in radiological monitoring. Radiological defense is an important function in providing for continuity of electric service in the event of a nuclear attack on the United States. Each electric power system must have a substantial and widespread force, trained and equipped, to detect and measure radioactivity. This will be essential for the conservation of skilled manpower, so necessary for the operation of their remaining system and the restoration and continuity of service for human survival. Three hundred courses have been held for electric power personnel. These, in turn, will instruct personnel in the industry to become radiological monitors and instrument operators for the detection of radioactivity. Additional courses at various locations will be given. The Inter-Agency Committee on Essential Survival Items, established by the Office of Civil and Defense Mobilization, agreed on a list of power items considered necessary for national survival in a post-attack situation. The Office of Civil and Defense Mobilization requested the Department of the Interior to supply information on usage and inventory, by locations, of those items necessary for the restoration of facilities for transmission and distribution of electric power. A questionnaire was sent to some 900 power systems. Over 80 percent of the systems have replied. The information obtained will be inserted in the Office of Civil and Defense Mobilization's electronic computer at the National Damage Assessment Center. It will also be of value to the Department of the Interior in defense electric power mobilization planning.

Preparedness for damage assessment in the event of an enemy attack requires the assembling of comprehensive data on electric generating plants and substations. Data on some 500 generating stations and 1,700 substations have been furnished and used in the computer at the National Damage Assessment Center. A survey is being conducted jointly by the Department of the Interior and the Federal Power Commission of all electric power generating stations in a capability of 10,000 kilowatts or over and substations of 500 kilovolt-amperes or over. This survey will broaden the coverage on generating stations to some 1,200; obtain data as to plant vulnerability; and add both generating stations and substations that have gone into service since the last survey.

Office of Saline Water

Dr. Arthur L. Miller, *Director*



IT IS ESTIMATED that the oceans of the world contain 32 million cubic miles of water. The goal of the Office of Saline Water of the Department of the Interior is to develop low-cost conversion processes that will permit us to utilize this vast inexhaustible source of supply, as well as to develop processes that will economically convert unmeasured billions of gallons of now unusable inland brackish water to fresh.

Encouraging progress gives hope that this goal will be reached.

The cost of converting sea water to fresh is being reduced, while at the same time, the cost of developing new supplies of natural fresh water is constantly increasing. In some localities these two curves have already crossed.

A milestone in the history of saline water conversion in the United States was reached this year when Coalinga, Calif., became the first city in the country to obtain its drinking water supply from converted brackish well water. For years the citizens of Coalinga had to haul in their drinking water at a cost of \$7 per 1,000 gallons. The installation of a conversion plant has cut their water bill to \$1.45 per thousand gallons.

In the coming years the same will be true for more and more of our cities and communities—water from the sea or brackish water sources will be the most economical and dependable source of supply.

Progress in the field of lower cost conversion or desalting of saline waters has been such that the initial period of exploratory research in the laboratory must now in part be replaced by field testing of the more promising processes. In recognition of this need and in view of the potential benefits, President Eisenhower

proved, on September 2, 1958, a new \$10-million authorization bill this requirement.

Public Law 85-883 authorizes the construction and operation of not less than five saline water conversion demonstration plants. Three of these plants will test sea-water conversion processes. One will be located on the east coast, one on the west coast and one on the gulf coast. At least two of these plants will have a designed capacity of not less than 1-million gallons of fresh water per day. Two plants will utilize processes for the conversion of inland brackish water to fresh. One will be located in the Northern Great Plains and one in the arid areas of the Southwest. One of these plants must have a designed capacity of at least 250,000 gallons per day.

As a part of the law, Congress established a timetable for the selection of processes to be tested in the demonstration plant program. This schedule required the Secretary of the Interior to select the first process on or before March 2, 1959, and the remaining four processes at three-month intervals thereafter.

To implement this new phase of the Saline Water Conversion Program, and at the same time increase the emphasis on research and development, the activities of the Office of Saline Water were divided into three interrelated divisions: Basic Research, Processes Development, and Demonstration Plants.

Basic Research

Low-cost saline water conversion is a problem which to date has not been satisfactorily solved. New ideas and new processes are needed and can be developed effectively through basic or fundamental research.

Fundamental research efforts conducted under contract with universities and research organizations by the Office have obtained good results and new knowledge has been developed.

Current fundamental research includes studies of scale deposition on heated surfaces, transport depletion, electrical control of adsorption, the use of algae, ion selective membranes, solvent extraction, retardation resins chelation, and possible utilization of energy in concentrated waste brines of conversion plants.

The formation of scale deposits in distillation equipment, and in some instances, electrodialysis equipment, is a serious problem, and it is important that methods for eliminating scale be developed. Fundamental research aimed at attaining a better understanding of scale formation and developing means of alleviating or controlling it is being carried on.



Using the sun's heat to desalt sea water. This solar research station south of Daytona Beach yields 500 gallons per day of fresh water.

Studies are being conducted on the electrical control of adsorptivity, a process based on the principle that a charge can be induced on a conductor, in contact with an electrolytic solution, by changing its electrical potential through an outside source. The soundness of the principle has been demonstrated and a rudimentary demineralization cell has been constructed and operated.

The conversion of saline water through the use of algae was suggested and an exploratory investigation was initiated. The theorized method would grow algae in a basin of sea water under conditions favorable for the uptake of salt by the algae. The algae would then be mechanically separated from the water and removed to a second basin where conditions would be such that the metabolism would be inhibited, causing the algae to deposit the absorbed sodium chloride. Over 100 different species of marine algae have been studied and six species have been found to accumulate sodium ions.

Fundamental research on ion-selective membranes is continuing and includes work on the development of a sulfate-specific membrane, development of laboratory test procedures for characterizing membranes, and the critical evaluation of all available ion-selective membranes.

Exploratory research on the possibility that fresh water might be extracted from saline water by means of certain organic liquids is under way. The method has been shown to be technically feasible.

and considerable potentially valuable scientific data has been obtained.

Several new proposals, some of which appear to have considerable merit, have been submitted for consideration during the year. It is interesting to note that a number of these have been received from major industrial firms.

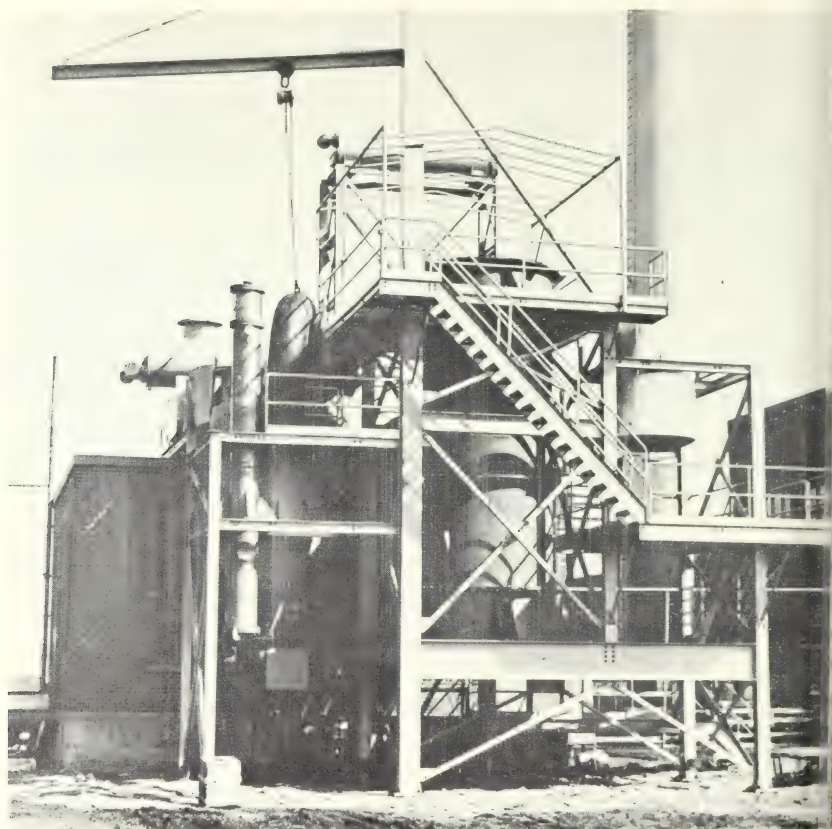
The investigation of these new ideas and the exploratory research leading to the development of new and improved processes is the responsibility of the Basic Research Division. As laboratory investigations and experiments progress, additional laboratory work may continue while pilot plant activities and field testing on a larger scale becomes the responsibility of the Processes Development Division.

Processes Development

Excellent results have been obtained from the operation of a pilot plant located at Harbor Island, N. C. Testing the long-tube vertical multiple-effect distillation process under conditions that would be encountered in a full multiple-effect cycle, formation of one type of scale on heating surfaces, a major technological problem in distillation processes, has been eliminated at higher temperatures than heretofore possible. The pilot plant has been in almost continuous operation since its startup in November 1957. Further process improvements are anticipated through extended and more severe operational tests now underway.

Following basic research and laboratory development, a contract was awarded for a 15,000 gallon per day pilot plant to test a promising new freezing process. This process utilizes flash evaporation of sea water to produce ice and countercurrent washing to separate the ice-brine mixture. Inherent advantages of a freezing process, such as lower energy requirements to reduce the temperature of sea water to freezing as compared to raising it to the boiling point, and a lesser tendency towards scaling and corrosion, indicate that such a method should be able to compete economically with the developments in the distillation field.

Since 1952, electrodialysis has developed from a laboratory phenomenon to the point where it is now one of the leading processes for demineralization of brackish water. An extensive testing and evaluation of experimental electrodialysis equipment is underway at the Department's Bureau of Reclamation Laboratories in Denver, Colorado. An electrodialysis unit developed by the Netherlands TNO has been purchased for operational testing at the laboratory.



Sea water conversion pilot plant designed to convert 15,000 gallons of water a day to fresh. This experimental facility uses a direct-freezing process developed by the Carrier Corporation. After preliminary testing at the Syracuse, N.Y. headquarters of the company, it will be moved to a sea shore location for extensive tests on raw sea water.

A sea water conversion solar distillation research station has been established at Daytona Beach, Fla. Prototypes of various existing and improved designs of stills are being installed and operated as a means of further development. It is anticipated that this program will produce engineering designs and specifications for practical small plants and will point the way for future solar distillation plants of larger capacity.

Twenty-two process development contracts are in force. Distillation processes under study, aside from the long-tube vertical type, include flash evaporation, vapor-compression, rotary and tubular type with forced circulation. Phases of distillation applicable to many processes, such as scale formation, corrosion, heat transfer,

pretreatment of water are also under study. Contracts on membrane processes include electrodialysis, osmotic, and reverse osmosis. Freezing process investigations include controlled crystallization, multi-stage washing, direct freezing by flash evaporation and direct freezing by use of a secondary refrigerant.

Demonstration Plants

Much of the activity of the Office of Saline Water during the year has been directed to the inauguration of this program. National and worldwide interest brought an increased and continuous wave of inquiries, suggestions, proposals, and applications. The initial phase of the demonstration plant activity was the selection of the processes to be tested in this new program. A special board, representing science, industry, and government was appointed to study the economic feasibility and potential of various saline water conversion processes recommended by the Processes Development Division.

Seventeen separate processes were evaluated by the Selection Board in order to judge which process would best meet the criteria developed by the Office of Saline Water and the Selection Board for demonstration plants. After careful consideration the Board recommended the selection of the long-tube vertical multiple-effect distillation process for the first demonstration plant.

The development of the long-tube vertical processes started in 1964. The Office of Saline Water contracted with the consultant engineering firm of W. L. Badger & Associates of Ann Arbor, Mich., to conduct a detailed study of the potential economic advantages of a million gallon per day distillation cycles. This collaboration led to the establishment of the experimental facility at Harbor Branch, N.C. Favorable test results obtained from this pilot plant were the basis of the Board's selection of this process.

The newer commercial conversion plants utilize the multi-stage distillation process. Improved design and performance specifications proposed by the Office of Saline Water, and private research and industrial organizations, led to the selection of this process for the second demonstration plant.

An electrodialysis process was selected to be tested in the third demonstration plant. Six years ago this process was little more than a laboratory phenomenon. Today it is a commercial reality, becoming one of the most economical methods of demineralizing brackish water.

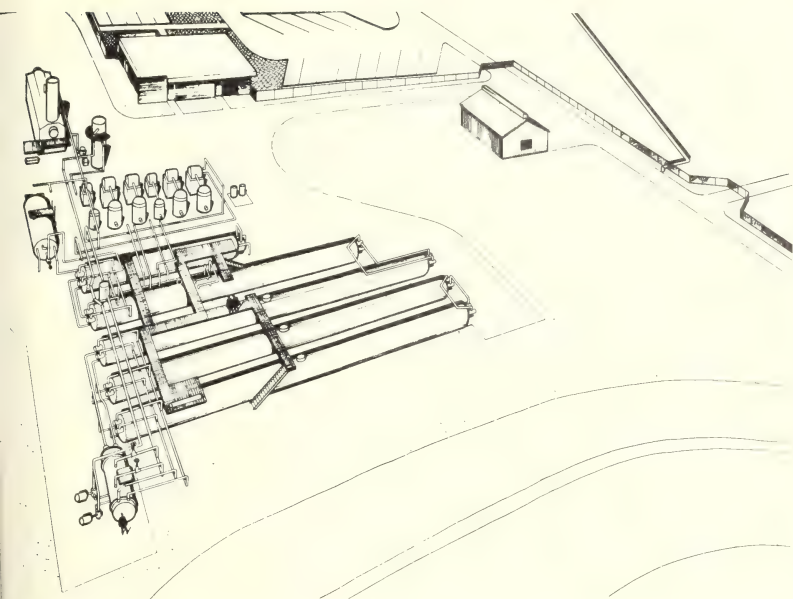
Electrodialysis utilizes a combination of electric current and thin ion-exchange membranes to remove the dissolved salts from water.



The developmental work on the long-tube vertical multiple effect distillation process, selected for demonstration plant testing in a 1-million gallon per day plant at Freeport, Tex., was carried on in this pilot plant located at Wrightsville Beach, N.C.

Site Selection

Over 175 cities and communities asked to be considered as a site for one of the five saline water conversion demonstration plants. A special Site Selection Board, composed of engineers from our Government with long experience in water supply problems, was appointed to evaluate these proposals and make recommendations to the Secretary of the Interior.



Dr. S. L. Kinsley's conception of the 1 million gallon per day multistage flash distillation process sea water conversion plant to be constructed on the California coast.

The Site Selection Board compared and evaluated information submitted by interested cities, together with technical site data obtained by personal inspection of proposed sites by staff engineers, with the exception of California sites, which were inspected by engineers of the California Department of Water Resources.

Based on these evaluations, members of the Board selected the most qualified sites and then conducted a comprehensive personal inspection of these sites before making their recommendation to the Secretary.

Proposed sites were evaluated by a rating system which compared technical factors (62 percent), demonstration value (24 percent), and assistance offered (14 percent).

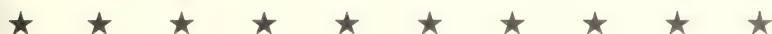
As the fiscal year drew to a close, a decision was reached on the location of the first plant. Acting on the recommendation of the Site Selection Board, Secretary Seaton selected Freeport, Tex., for the half coast plant which will demonstrate the long-tube vertical process. This plant will be designed to convert sea water to fresh at the anticipated rate of one million gallons per day.

Progress in conversion cost reduction has been made and will continue. Just prior to World War II, the cost of converting sea water

to fresh ranged upward from \$4 per thousand gallons. Since that time, even though rising cost indices have advanced all dollar costs, the cost of sea water conversion has been greatly reduced. In the most efficient existing sea water conversion plants the cost is now about \$1.75 per thousand gallons. It is anticipated that the two sea water distillation demonstration plants will produce fresh water from the sea for about \$1 per thousand gallons.

Office of the Assistant Secretary *Mineral Resources*

George A. Hardy, *Assistant Secretary*



THE ASSISTANT SECRETARY for Mineral Resources discharges the responsibilities of the Secretary of the Interior with respect to the Department's programs in the field of the development and utilization of minerals and metals, including mineral fuels. He exercises supervision over the Geological Survey, the Bureau of Mines, the Office of Minerals Exploration, the Office of Oil and Gas, the Office of Minerals Mobilization and the Office of Geography. The Assistant Secretary serves as the principal spokesman for the Department of the Interior in the field of mineral affairs at the policy-making level within the Federal Government. He participates in meetings of the Council on Foreign Economic Policy as the Department's liaison representative, and is the Department's representative on the Committee on Government Activities Affecting Prices and Costs.

The Office coordinates the Department's representation on the Advisory Committee for Export Policy and its operating committee. The interdepartmental advisory committees are utilized by the Department of Commerce in carrying out its responsibilities under the Export Control Act of 1949. As a result of extensive reviews of the lists of materials controlled for security and for short supply reasons, all materials except certain nickel-bearing items were removed from short supply controls.

In addition to the foregoing responsibilities, the Office of the Assistant Secretary, Mineral Resources, is the principal point of contact between the Federal Government and the mineral industries. Members of the staff of the Office of the Assistant Secretary, Min-

eral Resources, participated in a series of three meetings sponsored by the United Nations to consider possible international action to meet the problem posed by world over-supply of lead and zinc. The third meeting, held in New York in early May, witnessed the development of a limited arrangement to reduce production, export and sales of lead and zinc.

Legislation was submitted to the 2d Session of the 85th Congress to implement the long range helium conservation program which received presidential approval in the preceding fiscal year. The proposed measure reached the Congress too late to be considered. At year's end, the legislation, with some revisions, was ready for recommitment to the Congress.

The Office of the Assistant Secretary, Mineral Resources, continued to supply information and advice to the Director of the Office of Civil and Defense Mobilization concerning administration of the Government's strategic stockpiling program. The Office maintained a review of the overall stockpile situation and was active in the development of modifications in stockpile and stockpile disposal policies. Additionally, the Office continued its active role in advising the Department of Agriculture with respect to acquisition of strategic and critical material for the supplemental stockpile through barter transactions.

The Office continued its extensive participation in interdepartmental discussions dealing with basic problems of petroleum supply and requirements from both national security and peacetime economic standpoints. The Assistant Secretary, Mineral Resources, served as Chairman of the Oil Import Appeals Board, which was established to hear appeals arising from the program of mandatory import controls on petroleum and products.

The Office was active in the establishment of the Office of Mineral Exploration, and participated in the formulation of the policies and procedures governing its operations. The new agency administers a program of federal financial assistance to exploration activities, similar to that administered by its predecessor, the Defense Minerals Exploration Agency.

Geological Survey

Thomas B. Nolan, *Director*



CONTINUING AND CONSTRUCTIVE PROGRESS in our national technological knowledge has been an objective of the Geological Survey ever since Congress established this bureau as an agency of the Department of the Interior 80 years ago. Its surveys, investigations, and reports have helped dispel recurrent fears that maximum supplies of water, minerals, or energy would be insufficient to sustain the country's constantly increasing population. In retrospect, the history of the Department's Geological Survey has been characterized by major contributions to natural resource development and conservation activities.

Projected deadlines for the exhaustion of many non-renewable mineral raw materials and fossil energy sources have come and gone. Scientific research and related applied science and engineering have been successful in establishing and applying principles that make it possible to find hitherto unknown resources on the one hand, and to develop new techniques with which to transform formerly uneconomic minerals into usable products on the other.

Need for more and more water will continue to command a significant role for the hydrologic aspect of the Survey's scientific program. A steadily rising population and future expanded levels of economic activity will demand more complete map coverage of the United States. Field and laboratory work to determine the geologic conditions throughout the country and the physical and chemical conditions associated with geologic processes will be needed in the search for new ore and fuel sources and in producing a sound base for engineering construction and urban development required by a dynamic economy. Supervision of mineral lease operations on Federal and Indian lands and the classification of public lands as mineral and water power potential similarly are expected to climb.

with attendant increasing royalties for the United States Treasury, the States and the Indians.

The following report summarizes technical and publication activities of the Geological Survey of the Department of the Interior during fiscal year 1959. It illustrates how Survey scientists, engineers and administrators have shared in promoting the highest standard of living the world has yet seen:

Geologic Division

The Geologic Division is investigating and appraising our geologic and mineral resources through a continuing long-range research program of geologic mapping, and topical field and laboratory studies. This program is designed to provide fundamental data adequate to meet the varied and ever-increasing needs of the Nation in the fields of minerals and mineral fuels, engineering construction, water and land utilization, and educational and cultural activities. New geologic concepts and methods of exploration for mineral resources are under continuing review; existing principles and techniques are being refined and new ones are being developed.

Complementing its own program of research, the Division in 1959 continued to provide technical data and evaluations to many other government agencies. About one-third of the Division's funds were expended on such work. Many research studies in geology and geophysics, both in the field and in the laboratory, were conducted for the Atomic Energy Commission. Data and services were provided to the Armed Forces, the Puerto Rico Economic Development Administration, the International Cooperation Administration, the Office of Minerals Exploration, the Office of Mineral Mobilization, the Office of Oil and Gas, the Bureau of Public Roads, the Office of Defense Mobilization and others.

Cooperative programs were in progress with a number of State and Federal agencies. As in past years, Survey geologists served as consultants to the National Science Foundation and to various defense agencies.

Twenty-seven professional papers, 65 bulletins, 91 maps, and 10 circulars were published in the regular Survey series of publications. In addition 43 reports were placed on open file and approximately 250 reports were published in scientific journals.

Mineral Deposit Investigations

Field and laboratory research investigations that will contribute to increased knowledge of mineral resources are in progress in many fields.



Department geologist examining thin sections of potash ore with a petrographic microscope.

Among the new projects of this type is a full-scale investigation of axinite deposits on the island of Kauai, Hawaiian Islands.

Programs now in progress designed to build on the extensive data obtained during earlier Defense Mineral Exploration Administration activities, include a critical study of the Phillipsburg, Montana manantles deposits, determination of the regional relations of the North Carolina pegmatite districts, and the final phase of a long range study of the Coeur d'Alene mining district in Idaho.

Studies in the geochemistry of sea water, the concentration of important elements in the sea, and the deposition of these elements in sedimentary rocks were begun. Work continued on the development of techniques of geochemical prospecting. Investigations of isotope ratios, one of the more promising approaches to the problem of ore genesis and the location of new ore deposits, were also continued.

Investigations directed toward extension of known mineral districts include studies of the Ely, Nev., area which contains one of the large porphyry copper deposits of the Nation. Detailed studies of the Nation's largest known uranium reserves, at Ambrosia Lake, N. Mex., are directed toward determination of ore controls and help to discover extensions of ore-bearing strata.

In the continuing search for new mineral resources, 13,000 thin polished sections of rocks and minerals were prepared for examination by geologists, and nearly 14,000 samples were analyzed by chemical, spectrographic, X-ray, microscopic, and other methods.

Airborne radioactivity and magnetic data obtained while monitoring atomic reactor sites for the Atomic Energy Commission are providing new geophysical information on large areas of the United States, including parts of many mining districts. In fiscal 1955, 80,000 traverse miles were flown around 11 sites.

Field and laboratory investigations were made of the possibilities of electrical prospecting methods in the iron and copper ore districts of the Lake Superior region and the sulfide ore districts of northern Maine. Experimental measurements made in the Gogebic Iron Range of Wisconsin indicate that variable frequency electromagnetic techniques can be used to estimate magnetic susceptibility and hence the magnetite content of taconites. Such knowledge of a particular taconite would aid in tracing geophysically a concealed body of low-grade iron ore.

Geophysical and geochemical studies in the valley fill of the Lake Superior and Range Province are directed toward the discovery of concealed ore districts. Many ore districts in the bedrocks of the range are known, but two-thirds of the province is covered by young alluvial sediments. One of the greatest challenges to geology is to discover the major ore deposits that surely must exist, concealed beneath the young sediments. A new comprehensive geologic, geophysical, and geochemical exploration program was started in the Twin Butte, Ariz. porphyry-copper district where major new deposits have been found under alluvium.

Evaluation of areas of low-grade mineral materials that may eventually become sources of critically needed commodities includes a study of the environment and geochemistry of the large reserves of iron and other elements in submarginal sedimentary deposits and massive sulfide veins in the southeastern United States.

A study of the geology of rare-earth deposits, aimed toward evaluating their reserves, and understanding the geochemistry of these elements in different geologic environments, is in progress, as is a systematic evaluation of the Lake George beryllium deposits in Colorado, one of our principal domestic sources of this important element.

In the laboratory attention was directed to development of

more accurate methods for analysis of rarer elements such as tellurium, rhenium, niobium, and fluorine. An electron probe analyzer was developed for analysis of minute grains in rocks and minerals by exciting characteristic X-rays by which the elements in the mineral are identified and estimated without destruction of the sample.

An intensive program of fundamental research on minerals led to several important advances in knowledge of conditions under which mineral deposits were formed. Of immediate economic importance were field and laboratory studies of the borate minerals, and the discovery of a remarkable assemblage of rare minerals in the significant sodium carbonate deposits of the Green River formation of Wyoming and Colorado.

General Fuels Investigations

Mapping and stratigraphic studies designed to provide information needed for exploration programs were in progress in 24 petroleum-producing or potentially producing States. In six of these States the work was conducted in cooperation with State agencies. Investigations of coal-bearing areas were carried on in 10 States. Appraisals of reserves were continued in 5. A project was started to appraise the coal resources of Washington in cooperation with that State. A revised edition of the coal map of the United States was prepared for publication, and revision of the circular on coal resources of the United States was begun.

In conjunction with the Office of Oil and Gas and the Bureau of Mines, the Survey participated in a special study of the over-all potential of the United States petroleum industry in 1975. This extensive study is being undertaken by the Department of the Interior at the request of the Office of Civil and Defense Mobilization. A folio of paleotectonic maps and charts showing the distribution, character, and variations in strata of the Triassic system of the United States is in press. A similar folio on the Permian system is nearing completion.

The first aeromagnetic map of an entire State, the map of Indiana, was published in a professional paper. A theoretical map of the present surface derived from the magnetic data shows several structural features of possible significance in exploration for oil and gas.

General Service Geology

General service geology includes the gathering of geologic data needed in planning civil engineering works and programs of water



Geological Survey chemist removing a synthetic-sulfide mineral from a precision-controlled high temperature electric furnace.

and land utilization and fundamental research in various aspects of the earth sciences.

Thorough knowledge of earth materials is necessary for efficient land development. In metropolitan areas engineering geologic investigations were conducted in Los Angeles, San Francisco, Seattle, Portland, Oreg., Denver, Knoxville, and Omaha. Cooperative geologic mapping programs with the States of Massachusetts, Rhode Island, Connecticut, and with the Puerto Rico Economic Development Administration are in progress.

Geologic factors that complicate urban growth, such as landslides, mudflows, and cliff erosion were subjects of basic research.

Emphasis was placed on extending knowledge of such processes as rock metamorphism, the structural development of mountain

ion and deposition by streams and glaciers, and the growth of
s, as part of the program of fundamental research.

Generalized geologic maps of large areas, such as States or regions,
major tools in private mineral exploration and in many public
mining activities. New geologic maps, embodying the most up-to-
work from all sources, are in preparation for several States;
addition, a new summary tectonic map of the continental United
es, prepared in collaboration with the American Association of
roleum Geologists, is well underway.

Experimental work on solubilities and the formation of various
minerals in water and steam at high temperatures and pressures was
continued, and some of the results were applied to the study of
underground nuclear explosions. The study of radioactive products
in industrial nuclear processes was concentrated on the search
for natural mineral materials which will safely hold long-lived iso-
topes such as radiostrontium and radiocesium for future utilization,
without meanwhile endangering underground water supplies. Prob-
lems of clay conditioning for absorbent use were solved, and experi-
mental work on use of the minerals crandallite and vermiculite for
storing radioactive isotopes was done.

Research in stratigraphic paleontology by Survey specialists re-
sulted in the publication of 62 reports during the year. Many field

study of the effect of radioactive substances requires careful handling
of materials, as shown here in a tracer test conducted in a glove box.



parties were also visited by the specialists who supplied them with on-the-spot fossil determinations, thereby expediting solution of field problems.

Alaskan Mineral Resources

Alaskan activities were directed primarily toward appraising and aiding in the discovery and development of mineral resources as well as toward providing the needed geologic basis for industrial and agricultural expansion. About 850 miles of detailed geologic mapping and 34,000 square miles of reconnaissance mapping by ground and photogeologic methods were completed.

Field work on petroleum investigations was completed in two areas and reports were in preparation on three others. Preparation of a summary report on Alaskan coal resources continued, and a map of coalfields of Alaska neared completion. Detailed studies were continued in the Toffy-Eureka gold and tin district, and reports on tungsten areas north of Nome and tin deposits of western Seward Peninsula were in preparation. Studies of the applicability of geochemical prospecting techniques in northern latitudes continued. Preparation of four commodity maps showing the occurrence and distribution of 13 metals were completed. Geologic and geophysical studies at Cape Thompson, under Operation Plowshare of the Atomic Energy Commission, were continued.

Engineering geology investigations included mapping of surficial deposits near Fairbanks, site examination at military installations and preparation for the Bureau of Public Roads of a reconnaissance map along possible routes of a Fairbanks-Nome highway. Analysis of thermal data obtained over a period of several years is aiding in the solution of many construction problems.

Aeromagnetic and gravity data were obtained in several potentially petroliferous areas of Alaska. These data will provide additional subsurface geologic information as a guide for oil and gas exploration.

Military Geology

During 1959 reports on terrain analysis of U.S. and foreign areas were prepared for the Corps of Engineers, U.S. Army, by scientists in the Survey's Washington office. Numerous advisory services were provided on the military aspects of the geology of foreign territorial, and domestic areas. Technical assistance to the U.S. Army Corps of Engineers in Germany and Japan was continued.

Survey reports on the water resources of Okinawa and Saipan and on the military geology of Truk were published by the Corps Engineers. Preparation of eight additional reports on Okinawa, Saipan, Tinian, Guam, Truk, Miyako, and Ishigaki, and of professional papers on Ishigaki, Guam, Truk, and miscellaneous topical subjects was continued.

Field surveys of geologic and associated terrain and permafrost conditions in Alaska were made in the Copper River Basin and the Sewarddez area. Terrain studies of the Kuskokwim area, Seward Peninsula, and the Arctic Slope were completed. A professional paper on the Kuskokwim area was transmitted for publication. The Survey, in cooperation with the permafrost program of the Cambridge Research Center, U.S. Air Force, and with the glaciological program of the International Geophysical Year, continued studies along the Arctic Coast near Barter Island and in the adjoining Seward Peninsula area.

In addition to furnishing advice and studies to the Corps of Engineers, the Survey made field studies on problems in the Arctic, in cooperation with the Air Force.

During the year, studies were begun on a "terrain" analysis of the Moon. Investigations are being made of the feasibility of developing information on the physical characteristics and engineering properties of the lunar surface. Studies were also begun on the applications of military geology to nuclear warfare—primary attention being given to the ways in which soils, rocks and vegetation respond to the effects of nuclear weapons.

Foreign Geology

Fiscal 1959 marked the 19th year of Federal Geological Survey technical assistance to other nations under auspices of the Department of State. The intensity of Survey interest in and help to other nations in the training of geologists and the establishment of central geological services continued with the assignment of 52 geologic scientists to 15 countries.

Efforts have been directed along the following lines: (1) appraisal of resources in concert with our counterparts; (2) building and strengthening national central geological services through advice, consultation, and sharing of advances in methods and techniques in geologic research and investigation; (3) encouragement and direct assistance to geological departments in educational institutions in underdeveloped countries; and (4) the dissemination of knowledge of geologic processes and the sharing of geological information.

through the exchange of publications and joint publication of lingual reports on the cooperative work accomplished.

In-the-field cooperative geologic studies continued with counterpart scientific agencies in Brazil, Chile, Peru, Mexico, Libya, Pakistan, India, Thailand, Formosa, Indonesia, and the Philippines. Technical advice in the field of mineral resources was also extended to the Governments of Ghana, Hashamite Kingdom of Jordan, Japan, Korea, Saudi Arabia, Turkey, Iran, Afghanistan, Nepal, Burma, Paraguay, and Netherland Antilles.

Eighty-nine participants from twenty-four countries, under sponsorship of the International Cooperation Administration, the Atomic Energy Commission, and the United Nations, received training in the Geological Survey's domestic program. The training was supplemented in most instances with specialized graduate work at American universities. Under the Survey's Foreign Participation Photogeology Seminar at Washington, D.C., 24 young geologists from 15 countries received 7 months' office and field orientation and guidance in geologic interpretation and use of air photographs.

Library

Supporting Geological Survey investigations, the Survey Library continues to build its research materials for the use of scientists and engineers.

The Library has been active in the effort to expedite the translation of useful Russian works. More Russian material is becoming available and a considerable number of translations have been made or procured.

Activity in the Geological Survey Library in Washington and its branches in Denver and Menlo Park are summarized as follows:

| Activity | Washington | Denver | Menlo Park |
|---|------------|---------|------------|
| Publications received: | | | |
| Books, pamphlets, periodicals and serial parts | 24, 179 | 11, 595 | 8, 85 |
| Maps and charts | 2, 469 | 8, 075 | 8, 82 |
| Loans for use outside of Library: | | | |
| Books and other texts | 40, 851 | 10, 951 | 7, 74 |
| Maps | 2, 628 | 286 | |
| Well logs | | 1, 158 | |
| Loans, Interlibrary: | | | |
| Items loaned | 5, 627 | 1, 117 | |
| Items borrowed | 3, 657 | 1, 995 | 62 |
| Readers and users of books and maps in the Library: | | | |
| Survey members | 23, 497 | 19, 677 | 1, 62 |
| Others | 2, 630 | 1, 452 | 72 |
| Cataloging: | | | |
| Books, pamphlets cataloged | 11, 809 | | |
| New cards filed in the catalog | 35, 045 | | 3, 83 |
| Cards amended | 11, 423 | | |
| Copy for cards sent to Library of Congress | 350 | | |

Conservation Division

The Conservation Division classifies Federal lands as to mineral and water resources and supervises mineral-recovery under leases, permits, and licenses on Federal, Indian, and Naval petroleum reserve lands. A headquarters staff and a field staff of geologists and engineers make surveys, maps and reports dealing with water power, fuels, minerals, and chemicals essential to the economy of the United States; supervises mining and drilling operations to insure safe and economical production by private enterprise of coal, oil, gas, and other minerals; and supervises the operations of the Federal Petroleum Board.

General Classification

From field offices in Alaska, California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming, geologists made specific investigations which resulted in geologic reports and maps for use by the Survey itself, other bureaus of the Department of the Interior, and the public.

Maps and reports completed and released to public inspection in fiscal 1959 included geologic reconnaissance reports on foundation conditions at 18 prospective dam sites in Alaska and 13 in Oregon; structure contour map of the Maudlin Gulch-Temple Canyon-Danforth Hills oil fields, geologic map of Williams Fork Mountains oil field, geology of Coal Creek area, geologic map of Ragged Mountain coal area in Colorado; structure geology of Spence-Kane area, Little Sand Draw oil field, Sage Spring Creek oil field and vicinity, Teapot Dome and vicinity, and areal geology of West Essex field in Wyoming; structure map of Cut Bank area and geologic road logs of routes in Montana.

A total of 33,623 cases were processed which included 8,191 cases involving the outright disposal of Federal lands, either with reservation of minerals or with the reservation of one or more specified minerals, and 22,893 cases involving the Government's action under Federal leasing laws to lease a mineral substance from lands under its jurisdiction. This was a decrease of 2,226 over the number of similar cases for the previous year.

In addition, initial or revised definitions of 66 producing oil and gas fields containing Federal lands were issued; 315 unit-plan and participating-area proposals were appraised geologically; 23 determinations of the productive limits of producing oil and gas leases as found to exist on August 8, 1946 were made; the fact

and geologic significance of 194 new discoveries of oil or gas made on or affecting Federal-land leaseholds were reported; the competitive sale of oil and gas leases on 29 parcels of public land was recommended; 55 appeals from decisions of the Bureau of Land Management affecting the disposal of Federal lands were reviewed and reported upon; and 331 miscellaneous reports on the mineral potentialities of specific lands for various agencies of the Federal Government were prepared.

Water and Power

Investigations were conducted to determine the waterpower and storage possibilities of streams and lakes on Federal lands. These duties were carried out from a central office in Washington, D. C., and four field offices located in Denver, Colo.; Sacramento, Calif.; Portland, Oreg.; and Tacoma, Wash. Investigatory work in Alaska was supervised from the Tacoma, Wash., office.

Field work during 1959 was directed mainly toward obtaining basic information on the waterpower resources and storage possibilities of Federal lands in those States. Field projects completed during the year, or in progress on June 30, include surveys on Fryingpan Creek, Nenana River, Sweetheart and Virginia Lakes, Alaska; Kern, and Stanislaus Rivers, Calif.; Arkansas and Crystal Rivers, Colo.; Navajo River, Colo., and New Mex.; Lemhi River, Idaho; Chetco, Coos, Donner and Blitzen, Metolius, Pistol, Sixes, Siskiyou and Silvies Rivers, Oreg.; and the Entiat, Snoqualmie, and White Salmon Rivers, Wash.

The foregoing projects include about 590 miles of stream channel surveys and 21 dams site surveys. These projects normally extend over a 3-year period from start to map publication; for the current year the work completed would be the equivalent of about 370 miles of channel surveys and 20 dams site surveys.

As of June 30, maps resulting from previous field work were in various stages of preparation for publication for about 400 miles of stream topography and 9 dams sites. Maps published during the year covered 96 miles of streams and 12 dams sites. Maps completed and awaiting publication cover 276 miles of streams and 22 dams sites.

Two reports were approved during the year for open file release. In keeping with the program of making a systematic review of waterpower withdrawals, 14 reports were prepared which resulted in recommendations for the outright restoration of 113,000 acres and the restoration under provisions of section 24 of the Federal Power Act of 77,000 acres of previously withdrawn lands. Eighty-

our reports relating to water resources by other agencies were reviewed in the Washington office.

Classification activities resulted in the addition of 84,789 acres power site reserves and the elimination of 68,388 acres, leaving outstanding reserves in 23 States and Alaska of 7,222,063. Reservoir site reserves were reduced by 2,310 acres and now total 131,593 acres. Prepared and submitted to the Bureau of Land Management were 256 reports on the waterpower value of lands affected in applications for rights-of-way and 8,341 reports on applications for land acquisition. Fifty-seven reports on cases affecting power site lands were prepared and submitted to the Federal Power Commission.

Mining

Mining supervisory operations were concerned with the discovery, development, and production of coal, potassium, sodium, phosphate, and oil shale from public lands; of sulphur on public lands in Louisiana and New Mexico; of silica sand on certain lands in Nevada withdrawn by Executive Order No. 5105; of gold, silver, and mercury on certain Spanish land grants; of all minerals, except oil and gas, on restricted, allotted, and tribal Indian lands and on "acquired lands."

Outstanding mineral leases and permits on "acquired" and Indian lands involve the exploration for and production of copper, gold, iron, lead, manganese, silver, nickel, titanium, tungsten, uranium, radium, zinc, asbestos, bentonite, clay, coal, garnet, gravel, gypsum, halospar, fluorspar, limestone, mica, phosphate, pumice, quartzite, quartz, crystal, sand, silica sand, sulphur, and vermiculite.

Mining supervision includes responsibility for investigating and reporting on applications for leases and prospecting permits; recommending lease terms, enforcing compliance with lease terms and regulations governing the conduct of prospecting, mining, and beneficiation; protecting and conserving the natural resources by preventing waste; determining royalty liability; preparing statements and receiving payment of royalties and rentals.

As of June 30, 1959, there were under supervision 4,018 properties involved in leases, permits, and licenses in 34 States, of which 2,123 were on public land, 336 on acquired lands, and 1,109 on Indian lands. Annual production from such lands under supervision during the fiscal year is estimated at 26,159,403 tons, valued at \$7,027,891 with royalties amounting to \$7,831,504.

The production of coal from public domain lands in the United States aggregated 4,524,902 tons, valued at \$28,377,381 with a royalty

value of \$574,181. Potash production amounted to 13,984,156 tons of crude and refined salts valued at \$83,240,815 and royalty value of \$3,177,575 during the fiscal year..

The principal source of sodium was Searles Lake, Calif., accounting for 664,908 tons of the total of 954,460 tons of sodium and associated compounds produced from lands under supervision. Total value and royalty value of sodium were \$24,692,564 and \$813,500, respectively.

Phosphate rock and shale production was 2,107,687 tons—1,012,800 tons from public domain valued at \$3,418,304 with a royalty value of \$216,856; 1,860 tons from acquired lands, and 1,093,634 tons from Indian lands with a combined total value of \$1,298,500 and royalty value of \$129,531.

Production of lead and zinc concentrates from Indian lands amounted to 46,095 tons valued at \$111,236 and royalty value of \$9,647. The output of uranium and vanadium ores from Indian lands was 1,567,028 tons valued at \$22,912,711 and royalty value of \$2,582,703. Coal, sand and gravel, and other road surface materials made up the major part of the remainder of the production from Indian lands totaling 2,523,243 tons valued at \$3,544,685 and royalty value of \$258,513.

Clay, coal, feldspar, fluorspar, zinc, asbestos, limestone, phosphoric acid, mica, manganese, quartzite, quartz crystal, stone, and sand and gravel were produced from acquired lands in 12 States to an aggregate value of 425,674 tons valued at \$2,397,781 and royalty value of \$68,541.

Oil and Gas Leasing

Supervision of oil and gas leasing activities includes operations for the discovery, development, and production of crude oil, natural gas and products extracted from natural gas, on Federal, Indian, and certain Naval petroleum reserve lands. These duties were carried out during the year through 6 area offices and 21 district offices at 21 separate locations in California, Colorado, Louisiana, Montana, New Mexico, Oklahoma, Wyoming, and Washington, D.C.

On the public lands, 130,619 oil and gas properties were under supervision at the end of the fiscal year, aggregating 107,420,400 acres in 23 States. Drilling on public lands during the year included the spudding of 1,670 wells and the completion of 1,320 wells, of which 1,069 were productive of oil and gas. In all, 28,720 public land wells, including 16,851 capable of oil or gas production, were under supervision on June 30, 1959.

Production was appreciably greater than in fiscal 1958, amounting to about 145,030,000 barrels of petroleum; 442,976,000 cubic

et of natural gas; and 308,926,000 gallons of gasoline and butane, with a total value of about \$460,708,000 and royalty returns to the United States of about \$57,248,000.

There were 6,404 acquired land leases embracing 4,652,603 acres in 31 States under supervision at the end of the fiscal year. Drilling on acquired lands during the year included the spudding of 89 wells and the completion of 71 wells, 28 of which were productive of oil and gas. In all, 778 acquired land wells, including 307 capable of oil and gas production, were under supervision on June 30. Including compensatory royalty allocated to the Rio Vista gas field the production from acquired land was about 5,317,000 barrels of petroleum; 29,843,000,000 cubic feet of natural gas; and 459,250 gallons of gasoline and butane, with a total value of approximately \$22,000,000 and royalty returns of about \$2,850,000.

Operations were supervised on 12,445 leaseholds, embracing 4,329,000 acres on Indian lands in 15 States. Drilling on Indian lands during the year included the spudding of 982 wells and the completion of 928 wells, of which 704 were productive of oil and gas. In all, 10,895 Indian land wells, including 6,524 capable of oil and gas production, were under supervision on June 30. The total production from Indian lands was valued at \$167,000,000 and revenues from rentals, royalties, and bonuses amounted to about \$37,208,000. Drilling on military lands during the year included the spudding of one well and the completion of two wells, two of which were productive of oil and gas. In all, 102 military land wells, including 40 capable of oil and gas production, were under supervision on June 30. Royalty on the production of oil, gas, and liquid petroleum from military lands amounted to \$1,135,000 from a gross production value of \$8,000,000.

On behalf of the Department of the Navy, supervision was conducted over operations for the production of oil, gas, gasoline, butane, and propane from 17 properties under lease in Naval Petroleum Reserve No. 2 in California. Production from 310 active wells totaled 3,250,000 barrels of petroleum; 4,400,000,000 cubic feet of natural gas, and 12,800,000 gallons of natural gasoline with a total aggregate value of \$12,200,000 and a royalty value of \$1,600,000.

On the Outer Continental Shelf 183 section 6 leases, originally issued by the States of Louisiana and Texas, aggregating 774,491 acres, and 197 leases issued under section 8 of the Outer Continental Shelf Lands Act, aggregating 696,660 acres, were under supervision. At the end of the fiscal year a total of 1,483 wells, 897 of which were productive of oil and gas, were under supervision. Drilling on the Outer Continental Shelf involved the spudding of 277 wells, and the completion of 287, including 219 producers. The production of

petroleum from the Outer Continental Shelf in fiscal 1959 was about 64 percent greater than during 1958 and the production of gas was about 95 percent greater than during 1958 with a total product value of about \$126,798,000. Revenues received during the year, as royalties and rentals, totaled \$24,811,000.

Activities toward unitization of oil and gas operations involving Federal land were reflected in the approval of 80 new unit plans during the year and the termination of 42 previously approved unit plans, leaving 373 approved plans covering 6,889,246 acres outstanding.

On the Outer Continental Shelf, no such plans were approved and one was terminated during the year. The total now stands at embracing 311,399 acres. About 53 percent of the petroleum, 32 percent of the natural gas and 67 percent of the gasoline and liquid petroleum gas obtained from Federal lands during the year was produced under approved unit agreements. On Indian lands 2 new units were approved and one was terminated, the total number of plans in effect at the end of the year being 50, involving 81,7 acres.

There were 95 communitization agreements, or drilling units approved during the year, making a total of 876 outstanding as of June 30. There were four development contracts approved during the year. The total number of such approved contracts outstanding on June 30 was 11 involving 3,729,503 acres.

Connally Act Administration

The Connally Act of February 22, 1935, supports conservation activities of oil-producing States by prohibiting interstate shipment of oil produced in violation of certain State oil and gas conservation laws.

The act is administered by the Federal Petroleum Board under supervision and direction of the Geological Survey.

The Federal Petroleum Board consists of a chairman and one other active member on duty at the headquarters office in Kilger, Tex. Suboffices are in Victoria, Tex., and Lafayette, La. Altogether there are 25 field employees of the Board.

While the Connally Act is applicable wherever State laws limit the rate of production and prescribe conditions for producing and handling oil, its chief application is in the States of Texas, Louisiana and New Mexico, whose regulations prescribed under the act are enforced by the Board. With the limited resources at its command the Board also enforces provisions of the act in other oil-producing States, particularly in Mississippi, Oklahoma, Arkansas, and Kan-

Unless special exemptions are made by the Board in writing and notice, all operators producing oil within the designated area are required to maintain daily production records and file monthly production reports of operations on each lease in the oilfield as prescribed; also transporters and refiners are required to file monthly reports with the Board at Kilgore. The designated areas consist of 106 counties in Texas, the counties of Lea and Eddy in New Mexico, and the entire State of Louisiana.

From these areas the Board regularly received and processed each month approximately 10,300 monthly producer's reports, about 460 monthly pipeline reports, and 65 reports from processors and refiners. These covered operations in 3,853 separate oilfields and accounted for approximately 51 percent of the entire production in the States of Texas, Louisiana, and New Mexico, some 4,129,000 barrels daily.

During this fiscal year the number of oilfields reporting rose from 3,700 to 3,853, an increase of 153. Reports on producing wells rose from 91,808 to 93,109, an increase of 1,301 wells. Some 5,681 leases were inspected, 1,347 leases were visited, and 6 pipelines were checked. To accomplish this, 783 oilfields were visited and 1,479 interviews conducted.

There were 10 cases of alleged violation of the Connally Act on the docket of the Federal Petroleum Board when the fiscal year began and ten new investigations were started.

Three cases were closed by court action during the fiscal year and one was closed as to corporations but remains open as to individuals. Fines paid during the year as a result of actions initiated by the Board amounted to \$58,250.

On June 30, 1959, of the 17 cases remaining on the docket, 8 were under investigation by the Attorney General, 8 were under investigation by the Board, and in the remaining case the Board had a report in preparation.

Topographic Division

The Topographic Division prepares and maintains the National Topographic Map Series covering the United States and its outlying areas. This involves operations in five major mapping phases: aerial photography, geodetic control, photogrammetric and field surveying, cartographic operations, and map printing. Related activities include research and development in instruments, methods and procedures, the preparation of special maps, and supplying Federal



Exact and precise field survey work provides the basis for accurate mapping.

agencies and the general public with advance map materials, aerial photography, geodetic control lists, and map information.

During the year more than 1,700 new topographic quadrangle maps were published. Mapping projects were under way in every State, the District of Columbia, the Hawaiian Islands, Puerto Rico and the Virgin Islands. More than 21,000 different topographic maps are now published and distributed by the Geological Survey.

Through the International Cooperation Administration, the Division extends technical assistance to accredited representatives of other nations. During fiscal year 1959, extended periods of technical training were provided to a civil engineer from Brazil, a geologist from Pakistan, and a mining engineer from Thailand.

Briefer individual training periods were provided for cartographers from Norway, Panama, and Sudan, and for a geologist from India. The Division also supported three Geological Survey photogeological training programs for foreign participants, by providing a complete basic week of instruction in photogrammetry. Tours of Division mapping facilities or discussion of its activities and techniques were arranged for about 60 foreign visitors.

Other foreign work consisted of continued preparation of the 1:500,000 scale series of Arabia and revision of foreign maps for the Army Map Service.



The detailed work of map control planning is illustrated here by a member of the Geological Survey.

With passage of Public Law 85-743 in August, 1958 extending Department of the Interior functions to Antarctica, long range plans were made for mapping activities on that Continent.

A survey engineer was assigned to Byrd Station, Antarctica for 12 months. He is to accompany scientific traverse parties and conduct geodetic surveys to determine positions of major peaks and other landmarks to be used for mapping control.

An experimental 1:1,000,000 scale map in the Knox Coast area of Antarctica was prepared and printed, including a shaded relief presentation. A comprehensive library of cartographic materials relative to Antarctica was established, including maps, photographs, and geodetic control data.

The need for a uniform series of topographic maps has been generally recognized since the earliest days of the Geological Survey. The continuing expansion in our economy and changes in the requirements of civil and military map users have broadened the fields of map use. A research study has been started and the results will be used to guide the Division in determining scale, content, and format of the maps to be produced in the national mapping program:

A new building to house Topographic Division activities at the Geological Survey center in Menlo Park, Calif. was substantially completed and employees began the transfer from Sacramento. Completion of the move to Menlo Park is scheduled for September 1959.

The function of staff assistance to the Board on Geographic Names for domestic names activities was assigned to the Geological Survey on October 1.

Mapping Programs and Map Production

Within the United States, nearly 355 permanently marked triangulation stations were established to provide control for areas totaling more than 30,700 square miles. About 6,840 linear miles of traverse, 3,100 miles of electronic traverse, and about 15,400 linear miles of leveling were run, with permanent marks established at intervals of 2 to 3 miles. The computed results of these surveys are made available, on request, to other Government agencies and to the public.

Contracts were let for 73,304 square miles of precision aerial photography for topographic mapping purposes. The Air Force

Sighting in a supplemental topographic control work at Bodie Point, a cairn established more than a half century ago above what is now a California ghost town.





In desert area east of the High Sierras in eastern California, engineers conduct control surveys for topographic mapping.

covered aerial photographs covering 5,555 square miles for use in compiling topographic maps required by the Department of Defense. During the year, 2,439 maps were sent to the Publications Office of printing and distribution. Of this number, 1,136 were new standard topographic quadrangles prepared by the Geological Survey and 1,303 were new maps compiled by other civil agencies but published and distributed by the Survey. Also included were 180 Geological Survey revisions, 509 reprints of existing maps, 16 one-color advance editions, and 85 State index maps. In addition there were 366 civil editions of maps which had been prepared by the Department of Defense for military use, and 25 miscellaneous maps prepared on pilot format or for research, administrative, and informational purposes.



Aerial photographs are used here to establish elevations south of Vining, California.

A new 1:500,000 scale State map of Tennessee was printed. Compilation is in progress for new State maps of Maine, Minnesota, Montana, Nebraska, Nevada, North Dakota, South Dakota, Utah, and Washington.

The urban area map program continued with the printing of composite maps for Philadelphia, Denver, Norfolk-Portsmouth-New News, and Honolulu.

Several special mapping assignments were undertaken for the divisions of the Geological Survey and for other agencies. Included was the 1:1,000,000 scale series of North America for Army and Service, special coded overlays for the Office of Civil and Defense Mobilization, rural route maps for the Post Office Department, a photomosaic for the Bureau of the Budget, cartographic assistance on a new edition of the United States Water Resource Development map, and a special compilation for the Interstate Commerce Commission.

During fiscal year 1959, cooperative programs were in effect in 34 States, Puerto Rico, and the Virgin Islands. Ohio, Tennessee, and Florida increased their programs. Total cooperative offerings during the year amounted to about \$2,000,000.

A detailed summary of map production is shown in the following table:

Maps (in square miles) mapped or revised during fiscal year 1959 for publication on standard scales

[Contour intervals, 5 to 100 feet]

| State | Area mapped, scale | | Area re- vised | Total |
|----------------------|--------------------|----------|-------------------|--------|
| | 1:24,000 | 1:62,500 | | |
| Alabama | 1,163 | 1,241 | | 2,404 |
| Alaska | | 14,681 | | 14,681 |
| Arizona | 246 | 2,106 | | 2,352 |
| Arkansas | 225 | 944 | | 1,169 |
| California | 3,778 | 3,177 | 153 | 7,108 |
| Colorado | 1,048 | 504 | | 1,552 |
| Connecticut | | | 82 | 82 |
| Delaware | | | | |
| District of Columbia | | | | |
| Florida | 1,058 | | | 1,058 |
| Georgia | 826 | | | 826 |
| Idaho | 356 | | | 356 |
| Illinois | 343 | 1,063 | | 1,406 |
| Indiana | 636 | | | 636 |
| Iowa | 2,457 | | 524 | 2,981 |
| Kansas | 2,261 | 75 | | 2,336 |
| Kentucky | | | 1,116 | 1,116 |
| Louisiana | 290 | 2,812 | | 3,102 |
| Maine | | 286 | 265 | 551 |
| Maryland | | | | |
| Massachusetts | | | 465 | 465 |
| Michigan | 108 | 4,775 | | 4,883 |
| Minnesota | 1,329 | 1,647 | | 2,976 |
| Mississippi | 47 | 1,275 | | 1,322 |
| Missouri | 1,887 | | | 1,887 |
| Montana | 2,024 | 1,608 | | 3,632 |
| Nebraska | 1,226 | | | 1,226 |
| Nevada | 1,233 | 2,987 | | 4,220 |
| New Hampshire | | | 431 | 431 |
| New Jersey | | | | |
| New Mexico | 616 | 2,239 | | 2,855 |
| New York | 439 | 332 | 73 | 844 |
| North Carolina | | 1,101 | | 1,101 |
| North Dakota | 1,712 | | | 1,712 |
| Ohio | 1,150 | | 2 | 1,152 |
| Oklahoma | 60 | 1,025 | | 1,085 |
| Oregon | | 660 | | 660 |
| Pennsylvania | 932 | | | 932 |
| Rhode Island | | | | |
| South Carolina | 776 | 427 | 45 | 1,248 |
| South Dakota | 660 | 182 | | 842 |
| Tennessee | 634 | | 86 | 720 |
| Texas | 5,331 | 2,149 | | 7,480 |
| Utah | | 2,604 | | 2,604 |
| Vermont | | | | |
| Virginia | 25 | | | 25 |
| Washington | 874 | 721 | | 1,595 |
| West Virginia | 989 | | | 989 |
| Wisconsin | 645 | 475 | | 1,120 |
| Wyoming | 774 | 3,218 | 440 | 4,432 |
| Foreign | | | | |
| Alaska | 38,158 | 54,314 | 3,682 | 96,154 |
| Territories | | | 250 | 250 |
| Islands | | | | |
| World | 38,158 | 54,314 | 3,932 | 96,404 |

1:30.
1:00.

Research and Development

Research and development in instruments, methods, and procedures has expanded in all phases of map preparation by introduction of

operational-type research in the four area offices and the Branch Special Maps.

A new signal lamp has been developed for use in field survey. An efficient two-transistor circuit causes the lamp to flash at constant intervals. This permits the signal to be identified under difficult daytime conditions of observation and precludes sighting the wrong light source or on an image from light reflecting objects in the same general area.

The new four-wheel-steer elevation meter was used on several operational projects. The meter obtains supplemental control elevations in a fraction of the time required by other accepted methods but its use is limited to projects with a good distribution of travelable roads and of sufficient area to provide a large volume of work.

Using new electronic distance-measuring equipment for control surveys produced a remarkable increase in accuracy attainable at greatly reduced cost.

New photographic emulsions commercially available during the year were tested. One of the new emulsions showed considerable improvement in quality and was adopted for use on all aerial photography projects.

Research was continued on the development and testing of the "direct geodetic restraint method," a completely analytical system of aerotriangulation. The results of tests to verify the geometrical approach and correctness of the electronic computer program indicate that the system can attain a high degree of accuracy with a few photographs and control.

Tests also were made of horizontal and vertical block adjustment of aerotriangulation by means of the Jerie-International Training Centre analogue equipment. This was developed in Delft, the Netherlands, and uses an ingenious new method to adjust discrepancies in positions and elevations. After successful completion of the tests, procurement of the equipment was undertaken.

The Survey cooperated with the Engineer Research and Development Laboratories, Corps of Engineers, in a project to test the accuracy of the Decca system in determining exact positions of an airplane for a series of exposure stations and for other purposes.

The long-range plan for designing, developing, and procuring high-precision photogrammetric instruments to replace the Multiscope has been completed. More than 300 photogrammetric units are now in operation, a major percentage of them of a type designed and developed in the Topographic Division. The instrumentation includes means for map compilation from vertical and oblique photographs.

Modifications of the Twinplex instrumentation are nearing completion and a new system has been developed for calibration. This system and certain mechanical modifications promise a higher accuracy potential needed for successful horizontal and vertical stereoregulation of twin low-oblique photography.

Building a prototype of the universal model of the Orthophotometer began. The new model of this instrument has been designed to use a high degree of automation applying electronic read-out devices. It will accommodate any dichromatic projection equipment in use. A simpler, less costly, standard model has been designed which will provide satisfactory orthophotographs under most conditions of terrain and photography, using only ER-55 projectors.

Research and development continued on improving the efficiency of map-finishing techniques. This included design of new register machines, use of the dye scribe technique to speed up the map revision process, design of new elevation figure plates, and development of new and improved scribing instruments.

Map Information

Facilities for supplying information on maps, aerial photography, geodetic control surveys to Federal, State, and local government agencies, and to the public are maintained at the Map Information Office in Washington and at the Division's field offices. Services include over-the-counter map sales for the convenience of the public, commercial firms, and Government agencies; sale of prints of aerial materials from current topographic mapping; assembly of mill maps, photographic and geodetic control data to meet the requirements of Federal agencies; and the preparation of maps showing the current status of mapping and aerial photography.

The Map Information Office continued to serve as the central repository for maps which make up the National Atlas of the United States and provide economic, physical, and cultural information.

Water Resources Division

The Geological Survey is responsible for determining, appraising, and describing surface and underground water resources to aid in the solution of national water problems. The great impact of presently water problems is felt in its field offices throughout the country where information based on the results of investigations is applied to answer thousands of requests each year. With ade-



Geological Survey physicist inspects thermocouples on meteorological equipment in Nebraska.

quate knowledge, conservation and sound management of available supplies is possible.

Water-resources investigations include the systematic collection, analysis, interpretation, and publication of hydrologic and related geologic data; appraisal of water resources of specific areas; studies of water requirements for industrial, domestic, and agricultural uses; and research and development to improve the scientific basis and techniques of investigations. The results appear as scientific or technical reports and papers. During fiscal year 1959, the Division published 71 water-supply papers, 8 circulars, and 4 professional papers. In addition, 62 reports were placed in open file, and 260 manuscripts were approved for publication in scientific journals.

The program of water-resources investigations is a coordinated effort between Federal, State, and local agencies. Federal-State cooperative investigations began in 1895 and this kind of work has grown steadily, now constituting about 60 percent of the total program. Funds made available by States and municipalities in cooperation for cooperative investigations include:

*State and Municipal Offering for Cooperative Water Resources
Investigations*

| State | 1959 | State | 1959 |
|-------|-----------|----------------|-----------|
| Ala. | \$184,378 | Nebraska | \$107,988 |
| Ala. | 7,375 | Nevada | 52,546 |
| Ala. | 210,035 | New Hampshire | 18,857 |
| Ala. | 76,907 | New Jersey | 160,411 |
| Ala. | 705,090 | New Mexico | 252,089 |
| Ala. | 151,094 | New York | 354,653 |
| Ala. | 47,540 | North Carolina | 174,206 |
| Ala. | 52,929 | North Dakota | 74,495 |
| Ala. | 318,879 | Ohio | 197,777 |
| Ala. | 159,105 | Oklahoma | 99,005 |
| Ala. | 15,000 | Oregon | 106,447 |
| Ala. | 150,271 | Pennsylvania | 201,077 |
| Ala. | 67,513 | Puerto Rico | 49,762 |
| Ala. | 94,748 | Rhode Island | 37,225 |
| Ala. | 182,995 | Samoa | 5,250 |
| Ala. | 87,744 | South Carolina | 38,305 |
| Ala. | 136,205 | South Dakota | 56,505 |
| Ala. | 165,877 | Tennessee | 111,411 |
| Ala. | 195,064 | Texas | 430,069 |
| Ala. | 20,492 | Utah | 200,753 |
| Ala. | 67,797 | Vermont | 12,464 |
| Ala. | 72,286 | Virginia | 22,077 |
| Ala. | 114,455 | Washington | 174,638 |
| Ala. | 161,130 | West Virginia | 34,576 |
| Ala. | 89,705 | Wisconsin | 74,694 |
| Ala. | 47,446 | Wyoming | 93,432 |
| Ala. | 73,199 | Total | 6,795,971 |

cal year 1959 saw a widening interest in coordinated comprehensive planning of water resources development. For this purpose, Congress established two river basin study commissions. The Senate established a select committee to study the development and coordination of water resources. Also evident in 1959 was the growing nationwide interest in water quality. Concern about the effect of radioactive fallout on our water resources was front page news for a while. Less publicized, but equally timely, was the recognition of water-quality down-grading in some areas, caused by discharging domestic, industrial, and agricultural wastes to streams and subsurface reservoirs.

The following water problems are of paramount importance in relation today and involve aspects that are definite responsibilities of the Geological Survey:

1. Impact of a growing and shifting population on water supplies, accompanied by an accelerated increase in water requirements for industrial and agricultural developments.
2. Limitations on water development and use brought about by radioactive and chemical waste disposal from municipalities, industries, agriculture.
3. Effects of land use practices and urban development upon existing water supplies.
4. Water losses through evaporation and inability to capture plus runoff for later use.

5. Contamination of fresh water supplies by salt water intrusion in adjacent coastal and inland areas.

6. The need to determine sources, character, and potential surface and ground waters of marginal chemical character that might be suitable for application of saline water conversion methods.

7. Legal questions arising out of laws on water rights, flood zoning and insurance, or compacts between States.

8. Floods and the need for adequate design and operation of flood control structures, forecasting flood stages and volumes, and enactment of flood zoning and insurance regulations.

Surface Water Investigations

Streamflow and other surface-water data were obtained at 71 sites distributed throughout the 49 States and Hawaii, Guam, Samoa, and Puerto Rico. A special summary of all streamflow records for the period 1888-1950 is 98 percent complete. The report for the South Atlantic slope basins (James River to Savannah River), St. Lawrence River basin, the Great Basin, and for several Pacific slope basins were published.

Flood-frequency analyses for New England and for the Colorado River basin, part of a nationwide study of regional flood frequencies were completed. Pending completion of the nationwide study, the Division is making preliminary State-wide analyses in cooperation with several State agencies. Analyses were completed and reports were released to the open files for Ohio, North Dakota, South Dakota, and Florida. A report on the Delaware River Basin flood frequency was also released.

Three flood reports were published as water-supply paper circulars:

Summary of Floods in the United States during 1952

Floods of October 1954 in Chicago area, Illinois and Indiana

Floods of June-July 1957 in Indiana

Work is in progress on several other flood reports including flood of January-February 1959 in Ohio and Indiana.

Runoff studies of maximum annual floods were made for 11 areas, all for drainage areas of less than 400 square miles, at the request of the Soil Conservation Service. Hydraulic data for drainage-structure sites were furnished to highway departments of 11 States.

A manual of hydrology was started, describing the techniques of surface-water hydrology that are used by the Survey. The manual will be published as separate chapters, each chapter dealing with



geologist conducts velocity measurements as one step in determining the water discharge of a stream.

During the year, six chapters were approved for publication.

Interstate compacts for the apportionment of interstate waters usually include provision for measurement of streamflow, commonly by the Geological Survey. Nineteen such compacts are in effect and others are under negotiation. Water-resources investigations continued along the Canadian boundary, as required by the Boundary Water Treaty of January 11, 1909, between the United States and Canada, or by order of the International Joint Commission.

Ground Water Investigations

The major part of the program of ground water investigations for the year 1959 consisted of studies or appraisals of the ground water resources of specific areas in different parts of the 49 States, Alaska, and Puerto Rico.

During fiscal year 1959, work progressed on 640 ground water projects. Cooperative investigations supply many local needs water facts. However, such water sources as rivers and water-bearing formations are independent of political boundaries and Federal financed programs must supplement cooperative work in local areas. The work in the Mississippi Embayment, a project encompassing 90,000 square miles in parts of nine States with a common ground-water basin subject to intense development of water industrial, municipal, and agricultural use, is such a project continued during fiscal year 1959.

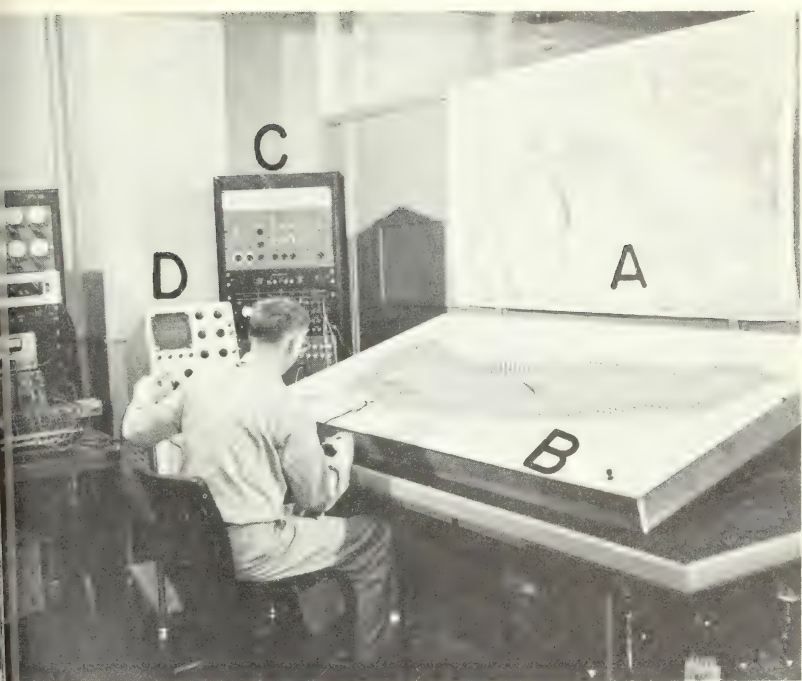
A start was made on the hydrology of basalt terranes, a study of a typical area to uncover new methods for finding and developing ground water in the Pacific Northwest. Principles developed in this study will be applicable to any area underlain by similar geologic and hydrologic conditions. Another type of study, equally valuable is a series of projects on salt-water encroachment in coastal areas of the Nation. Of particular significance are salt-water studies progress in Hawaii, in eight States in the Southeast and in several Northeastern States.

In the search for new tools and techniques with which to approach water problems of the future, a research team completed work on two analog computers into which can be placed geologic and hydrologic data and from which data can be obtained regarding the response in water-bearing formations to water withdrawal or injection. This approach offers great promise in the investigation of hydrologic systems.

Chemical Quality of Water Investigations

Basic investigations of the chemical character of water supplies in the United States were continued in 1959. Supplementing nationwide programs were more detailed studies of water-quality conditions in the basins of the Colorado, Missouri, Pecos, Columbia, Connecticut, and Yadkin-Pee Dee Rivers, and in Alaska. Included as part of ground-water programs was the assessment of chemical quality of underground supplies.

The program included the beginning of studies of the distribution and concentration of radioactive waste in streams by fluvial sediment. A modest start was made in measurements of synthetic detergents as related to the quality of ground water supplies in the United States. Studies continued on worldwide runoff of dissolved solids from land surfaces to the oceans. Study continued of the significance and potential use of tritium as a tracer and age determinant in water investigations.



erical model for predicting effects of ground-water pumping: (a) logic map of typical arid basin; (b) electrical model simulating hydrologic properties of basin; (c) equipment for varying flow of electric current to simulate ground-water flow; (3) oscilloscope for observing instantaneous "ground-water conditions" at selected points.

Among reports prepared were those on the chemical quality of surface waters of South Dakota with special reference to selenium, boron, and fluoride; a study and interpretation of the chemical characteristics of natural water; a survey of analytical methods applicable to the determination of strontium in natural waters; and distribution of uranium and radium in ground waters of the United States.

Recent Investigations

Studies of sources and movement of sediment in streams were continued in 1959. Detailed work in the Missouri, Colorado, and the Rio Grande Basins included measurement and analysis of sediment loads and related factors important to the extensive irrigation programs of water use in these areas.



Geological Survey hydraulic engineer using a battery-powered cable and sounding equipment to make streamflow measurements from a cable high above the Columbia River.

Other studies include the relationship of sediment transport roughness and shape of stream channels; bedload discharge of sediment; development of automatic equipment for measuring sediment discharge of streams; and improved techniques and standards for analyzing and interpreting sediment data and records.

Investigations of sediment yields and trap efficiency of reservoirs in small watersheds continued in collaboration with the Soil Conservation Service. Sediment studies were made for the Bureau of Reclamation in the Rio Grande and Colorado River Basins and for the Soil Conservation Service in the Medicine Creek Watershed of Nebraska.

A comprehensive study of the Delaware River basin, which began during fiscal 1957, was completed and chapters on ground-water occurrence, geology, and sediment have been delivered to the Corps of Engineers, to be included in their comprehensive plan of development for the basin. Additionally a hydrologic atlas and a professional paper were prepared for Survey publication to present the results of this investigation. A similar study of the

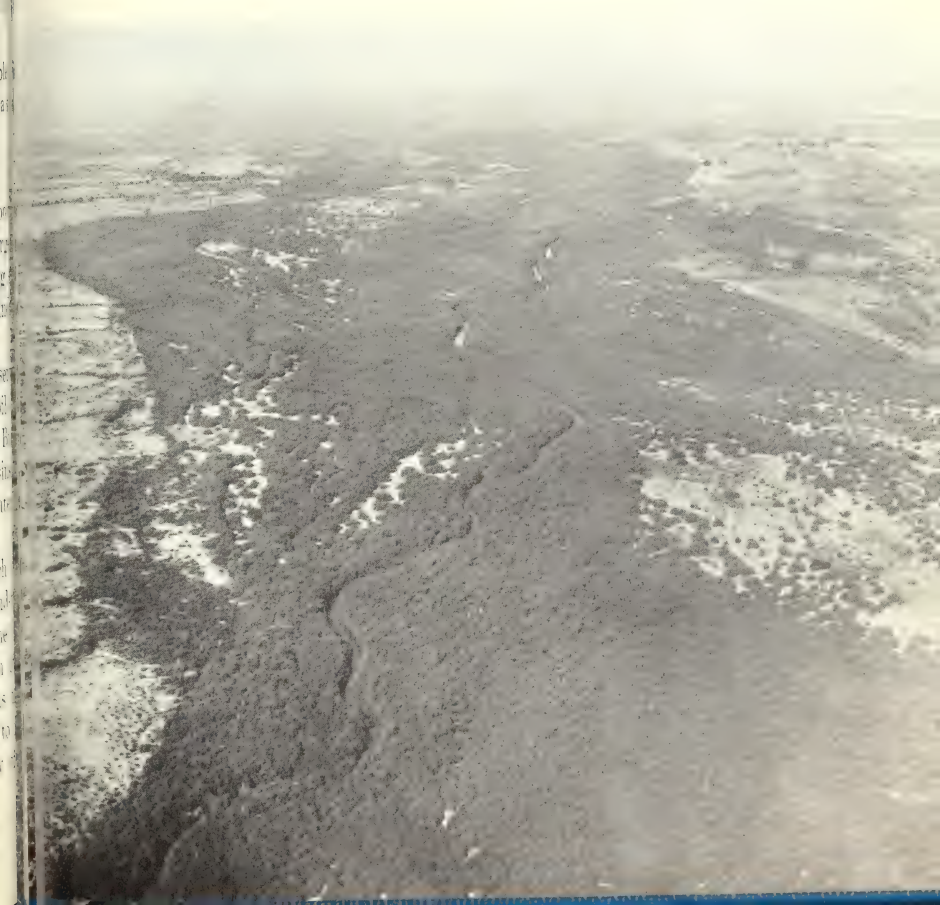
hydrology of the Colorado River basin above Lees Ferry, Ariz., is continued during the year and scheduled for completion during 1961. All aspects of the occurrence, use and availability of water are being covered with special emphasis on chemical quality and the interrelationships between surface water and ground-water supplies.

A report on water requirements of the copper industry will soon be printed. Similar reports on the petroleum industry, steel and synthetic rubber are in progress.

Manuscripts on the water resources of metropolitan areas of Los Angeles, Calif.; Syracuse, N.Y.; and Springfield, Mass., have been completed and publication is expected early next year.

Work continued on a series of publications which will summarize knowledge about the water resources of each State. Drafts of manuscripts are complete or have been started for Alabama, Ari-

Work toward reducing phreatophytes (water-loving weeds) that grow in many stream valleys is one of Geological Survey's activities contributing to water conservation in the arid West.



zona, Delaware, Georgia, Idaho, Oklahoma, Oregon, and Rhode Island.

In the interest of conserving water and to reduce flood hazards in sections of the arid West, scientists are studying the problems of phreatophytes (water-loving plants) that grow in many stream valleys. In addition to wasting large quantities of water through evapotranspiration, these plants develop a junglelike growth that invades and chokes the normal overflow channels of streams. Flood waters back up and spread out on adjacent farmland. Projects are now underway to determine the effect and economic feasibility of eradicating large areas of these weeds.

Soil and Moisture Conservation

Continuing activities included investigations of hydrologic and geologic conditions on public lands to provide data needed by other bureaus of the Department of the Interior for the management of those lands. Investigations were made of water supplies in grazing areas in Utah, Nevada, Idaho, and California. Data on runoff and sediment yields were collected for reservoirs constructed as part of the conservation program on public lands in Montana, Wyoming, Colorado, Utah, New Mexico, and Arizona. Studies in stream morphology, aggradation and degradation were made in Arizona, Nebraska, and Wyoming.

Research and Development

Increasing demands upon the country's water resources, irrespective of their origin, require, as a byproduct, an increasing technical proficiency in delineating the magnitude of the resource, devising procedures for its use, and anticipating the effects of different management practices. To fulfill its responsibility for technical aspects of our water resources and the hydraulics of natural channels, the Geological Survey conducts an active research and development program.

A more complete evaluation of the water available from our Nation's streams requires an increased number of gaging stations. This demand, in turn, has led to an intensive search for new and better instruments for measuring the flow of water in channels and for new procedures for the processing and analysis of data. The objective of these efforts is to reduce cost, increase the speed with which streamflow data can be made available to the public, and present such data in their most useful forms.

More intensive use of surface waters has resulted in demands for greater knowledge of the hydraulics of open channels, and of

physical behavior of water and sediment in stream systems, including those subject to tidal flow. Such demands are being met by special investigations in the field, coupled with investigations in laboratory flumes and conduits.

In many areas the more intensive use of water is leading to conflicts between users. Special studies have been undertaken to aid in their resolution. Those now under way seek to learn the effect of water management and other conservation practices on the quantity and quality of water at locations downstream from treated areas. Another important Survey study in this field is the effectiveness of adding chemical films to reduce evaporation.

While the great ground-water reservoirs which yield so much of our domestic and municipal water supplies appear to lend themselves to management, a great deal is yet to be learned regarding the movement of water through porous media below ground.

Use of water always modifies its quality. Thus while the chemistry of water must be completely defined, there is much to be learned about the behavior of water solutes. Problems of radioactive waste disposal and the use of radioactive elements as tracers are increasing the need for research in this field. Studies are under way on the chemistry of iron in water, of exchange phenomena and chemical reactions of radioactive substances, of the geochemistry of trace elements in water, and of the mineral constituents in ground water and their genesis.

Technical Assistance Program

Activities under auspices of the International Cooperation Administration's Technical Assistance Program continued at about the same level during fiscal year 1959. Long-term projects were carried on in Afghanistan, Chile, Iran, Libya, Pakistan, Philippines, Saudi Arabia, and Taiwan. Personnel were assigned for short periods to Cambodia, British Guiana, Philippines, Tunisia, and Turkey to assist in modernizing or expanding surface- or ground-water resource investigations.

Technical assistance given continued to emphasize establishment and strengthening of foreign governmental organizations engaged in water resource investigations. On-the-job training in methods and techniques and advisory assistance in organizational phases are the principal mechanisms of this assistance. Survey personnel have given in-country training to more than 100 citizens of nations where long-term projects are being conducted. Citizens of Afghanistan, British Guiana, Chile, Guatemala, India, Pakistan, Philippines, Taiwan, Tanganyika, and Turkey received training in the United States.

Publications

Information on the physical features of the country and f necessary for the exploration, development, and conservation of mineral and water resources are developed through investigati surveys, and research, the results of which are made available publication of a variety of reports, maps, and charts.

The information is published in part by the Survey, in part cooperating States, and in part by many scientific journals. T publications include maps of the topographic and geologic feat of the Nation, studies of mining districts and mineral deposits the composition and structure of rocks and minerals, of fossils the rocks in which they are found, of geophysics and geochemis and studies of streamflow, ground waters, and their chemical qua

During the fiscal year, 1,015 reports including geologic and hy logic maps were submitted for publication. Of these 288 were publication by the Geological Survey, 40 as professional papers, 58 as bulletins, 71 as water-supply papers, 13 as circulars and in the various map series, the balance, 727 were for publication cooperating agencies or by scientific journals.

Preparation

In this period, 193 new manuscripts were sent to the printer and 182 were published. Work on new manuscripts prepared in fiscal year 1959 included editing and preparing for printing 35,157 pages of manuscripts; checking 4,724 galley proofs and 70 page proofs. Indexes compiled consisted of 25,461 entries. Prepared reports delivered included 28 professional papers, 67 bulletins, 61 water-supply papers, 8 circulars and 18 miscellaneous items.

Technical Illustrations

During fiscal year 1959, illustrations for 239 new reports completed and sent to the printer. This number consisted of 67 bulletins, 37 professional papers, 23 water supply papers, 8 circulars, 100 geologic map series, and 4 geologic map series reprints. An additional 40 illustrations were completed for various administrative reports, open-file reports, outside publications and miscellaneous services.

Work is progressing on three maps of special interest, namely a revised Geologic Map of North America, a revised Tectonic Map of the United States, and a reprint edition of the Geologic Map of the United States.

Map Reproduction

Final reproduction of maps and charts as well as many of the multicolor illustrations in the book reports prepared by the Geological Survey require photography, lithography, and related techniques performed in the map reproduction plant of the Survey.

Materials submitted for reproduction are routed through the various operational steps which consist of line and halftone photography, plastic and metal plate preparation, lithographic offset press printing and finally the trimming and finishing of the completed publication.

The ever increasing demands for published information require careful analysis of present and future printing and publication requirements, as well as constant research and sound management practices. These efforts have resulted in the streamlining of operations, the installation of high speed and larger equipment, and the modification of procedures and materials involved in the publication of both new and revised or reprinted maps and charts.

Also, new materials and procedures have been adopted in the carrying out of field projects which have resulted in improving the efficiency of both field operations and subsequent cartographic and photographic operations. Permanency of the printed record is of prime importance. In this respect, a constant upgrading of lithographic inks, papers, and photographic material and their compatibility not only with each other, but with usage, storage and the elements, receive continued investigation and study. The following summary of map reproduction work completed during the year:

| | New | Reprinted |
|----------------------------------|-------|-----------|
| Photographic Division maps: | | |
| Standard topographic | 1,716 | 2,278 |
| Standard topographic (engraved) | 1 | 186 |
| Standard topographic (revisions) | 195 | |
| 2,000 scale | 101 | 11 |
| Map conversions | | 135 |
| Map metric | 5 | 7 |
| Map base | 4 | 4 |
| Map topographic indexes | | 77 |
| Miscellaneous | | 8 |
| Geographic Division maps: | | |
| Geologic quadrangles | 10 | |
| General investigations | 34 | |
| Geologic indexes | 3 | |
| Map | 1 | 1 |
| Map and gas maps | 5 | 1 |
| Map and gas charts | 3 | 1 |
| Map geologic | | 1 |
| Map physical investigations | 21 | |
| Map geologic status | 4 | 3 |
| Miscellaneous investigations | 29 | 3 |
| Photoduplication Division: | | |
| Map Survey | 6 | |
| Total | 2,138 | 2,716 |

Includes 14 printed by other Government agencies.

Includes 7 printed by other Government agencies.

These 2,854 new and reprinted map editions comprise 9,652 copies of which 9,615,032 copies were printed in the Survey's plant. These maps range in size from 13 by 18 inches to 50 by 72 inches.

In addition to the foregoing production, 1,250 jobs comprising miscellaneous maps and other preliminary map services were completed. This printing includes 354 maps amounting to 1,703 copies of which 162 were illustrations comprising 565,971 copies for the Government Printing Office for use in the Survey's bullet reports. The rest of the miscellaneous printing and service was done for other units of the Government, including branches of the Survey and various States. Also 2,879 type jobs (impressions on cellophane for map preparation) were delivered, and 826 maps were mounted on cloth.

The total cost of all production was \$1,621,675.65. Of this amount \$45,890.45 was received from other agencies for map sales and \$60,519.75 was paid by other agencies and miscellaneous organizations for printing or service work.

The summary of work performed in the Survey's plant includes: Reproduction and delivery of 11,318,373 map copies (53,030,200 impressions); preparation of 15,562 photolithographic printing plates, ranging in size from 24 by 30 inches to 55¾ by 73 inches; 4,705 photolithographic negatives; 44,783 photographic negatives and positives ranging from 2 by 4 inches to 40 by 80 inches; 10,560 prints ranging from 11½ by 2 inches to 40 by 80 inches; developed and printed 75 rolls of film; processed 19,869 sheets of strip film and prepared 500 lantern slides.

Distribution

Geological Survey reports and maps are distributed by mail in bulk stocks at Silver Spring, Md.; Denver, Colo.; and Fairbanks, Alaska. Direct over the counter sales are made from these and other specially designated locations.

In addition to more than 40 million items on hand at the beginning of the year, 313,746 copies of 188 separate reports in book and pamphlet form, which were printed by the Government Printing Office and the Interior Duplicating Section, were received. In addition, 9,652,327 copies of 2,854 new and reprinted maps

The distribution of approximately 4,312,600 maps, including map indexes, constituted a substantial increase of some 543,200 copies over the corresponding total for the preceding fiscal year. Approximately 251,950 book reports and pamphlets were distributed by the Survey during fiscal year 1959. In addition, slightly more

n 121,400 copies of the Survey's monthly announcement of new publications were distributed by the Superintendent of Documents. This total distribution was implemented in compliance with 300 individual requests and resulted in the collection of \$5,096.69 from the sale of maps to the public, which amount was deposited as miscellaneous receipts in the United States Treasury. The distribution of maps for official, educational, and Congressional was approximately 28 percent of all maps distributed. The total number of copies distributed by the Geological Survey during this year as compared with last is shown in the following table:

| | Fiscal year 1958 maps, map indexes and book re- ports | Fiscal year 1959 maps, map indexes and book re- ports | Percent of increase or decrease |
|--------------------|---|---|---------------------------------------|
| Washington..... | 2,519,350 | 2,787,158 | +11 |
| Field offices..... | 1,240,950 | 1,452,989 | +17 |
| Books..... | 31,000 | 38,957 | +26 |
| Field offices..... | 270,750 | 285,447 | +5 |
| Total..... | 4,062,050 | 4,564,551 | +12 |

Public Inquiries Offices

Public Inquiries Offices have been established in the following cities: Dallas, Tex.; Denver, Colo.; Salt Lake City, Utah; San Francisco and Los Angeles, Calif.; and Anchorage, Alaska. These offices stock Survey maps and reports concerning their respective areas, answer inquiries, and direct specific questions on technical matters to appropriate Division technical officers. Maps and reports are sold over-the-counter, but the offices are not equipped to handle large orders. Their operation facilitates distribution of the results of Survey investigations to the public.

Funds

During the fiscal year 1959, obligations were incurred under the appropriation of the Geological Survey totaling \$63,650,114. Of this amount 65 percent was appropriated directly to the Geological Survey, 20 percent was made available by other Federal agencies, and 15 percent by States or their political subdivisions, and miscellaneous non-Federal entities.

Source and use of funds in fiscal year 1959

Topographic surveys and mapping:

| | | |
|--|-------------|----------|
| Appropriation | | \$14,679 |
| Reimbursements from non-Federal sources: | | |
| States, counties, and municipalities | \$2,003,863 | |
| Sales to the public of aerial photographs and copies of records | 159,340 | |
| Miscellaneous | 39,706 | 2,200 |
| Reimbursements from other Federal agencies: | | |
| Bureau of Reclamation | 804,372 | |
| Department of the Army | 1,235,000 | |
| Miscellaneous | 232,779 | 2,275 |
| Total appropriation and reimbursements | | 19,140 |
| Direct State payments | | 10 |
| Total, topographic surveys and mapping | | 19,150 |

Geologic and mineral resource surveys and mapping:

| | | |
|---|-----------|--------|
| Appropriation | | 11,340 |
| Reimbursements from non-Federal sources: | | |
| States, counties, and municipalities | \$310,264 | |
| Miscellaneous | 19,434 | 360 |
| Reimbursements from other Federal agencies: | | |
| Office of Mineral Exploration | 290,615 | |
| Department of the Air Force | 161,300 | |
| Department of the Army | 1,298,772 | |
| Atomic Energy Commission | 2,216,608 | |
| Government Printing Office—map reproduc- tion | 104,473 | |
| International Cooperation Administration | 1,106,007 | |
| Miscellaneous | 251,631 | 5,440 |
| Total, geologic and mineral resource surveys and mapping | | 17,134 |

Water resources investigations:

| | | |
|---|-------------|----------|
| Appropriation | | \$11,287 |
| Reimbursements from non-Federal sources: | | |
| States, counties, and municipalities | \$5,663,314 | |
| Permittees and licensees of the Federal Power Commission | 210,102 | |
| Miscellaneous | 62,139 | 5,950 |

Source and use of funds in fiscal year 1959—Continued

er resources investigations—Continued

Reimbursements from other Federal agencies:

| | | |
|--|-----------|-----------|
| Bureau of Reclamation | 776,330 | |
| Department of Agriculture | 249,621 | |
| Department of the Air Force | 142,000 | |
| Department of the Army | 1,759,797 | |
| Department of State | 118,073 | |
| Atomic Energy Commission | 432,255 | |
| International Cooperation Administration ... | 498,044 | |
| Tennessee Valley Authority | 95,792 | |
| Miscellaneous | 346,253 | 4,418,165 |

| | |
|--|------------|
| Total appropriation and reimbursements | 21,631,599 |
| Direct State payments | 1,132,657 |

| | |
|---|------------|
| Total, water resources investigations | 22,764,256 |
|---|------------|

and moisture conservation:

| | |
|---------------------|---------|
| Appropriation | 174,000 |
|---------------------|---------|

ervation of lands and minerals:

| | |
|---------------------|-----------|
| Appropriation | 2,434,269 |
|---------------------|-----------|

Reimbursements from non-Federal sources:

| | |
|---------------------|-------|
| Miscellaneous | 1,020 |
|---------------------|-------|

Reimbursements from other Federal agencies:

| | | |
|-----------------------------|-----------|---------|
| Office of Oil and Gas | \$212,491 | |
| Miscellaneous | 48,652 | 261,143 |

| | |
|---|-----------|
| Total, conservation of lands and minerals | 2,696,432 |
|---|-----------|

General Administration:

| | |
|---------------------|-----------|
| Appropriation | 1,273,000 |
|---------------------|-----------|

Reimbursements from non-Federal sources:

| | |
|---------------------|--------|
| Miscellaneous | 14,400 |
|---------------------|--------|

Reimbursements from other Federal agencies:

| | | |
|--------------------------------|-----------|---------|
| Department of the Army | \$165,973 | |
| Atomic Energy Commission | 103,600 | |
| Miscellaneous | 195,548 | 465,121 |

| | |
|-------------------------------------|-----------|
| Total, General Administration | 1,752,521 |
|-------------------------------------|-----------|

Summary:

| | |
|---------------------|------------|
| Appropriation | 41,178,480 |
|---------------------|------------|

Reimbursements from non-Federal sources:

| | | |
|---|-------------|-----------|
| States, counties and municipalities | \$7,977,441 | |
| Miscellaneous | 506,141 | 8,483,582 |

| | |
|--|------------|
| Reimbursements from other Federal agencies | 12,845,986 |
|--|------------|

| | |
|---|------------|
| Total, appropriation and reimbursements | 62,508,048 |
|---|------------|

| | |
|-----------------------------|-----------|
| Direct State payments | 1,142,066 |
|-----------------------------|-----------|

| | |
|-------------------|------------|
| Grand total | 63,650,114 |
|-------------------|------------|



Bureau of Mines

Marling J. Ankeny, *Director*



IMPORTANT ADVANCES WERE MADE in virtually every phase of activity of the Department of the Interior's Bureau of Mines during the 1959 fiscal year. Outstanding among the noteworthy developments were:

Metallurgical achievements.—Pioneering experiments by Bureau scientists produced the world's first shaped casting of molybdenum metal, a feat that attracted widespread public interest and promised solutions for some of the many difficult problems encountered in the Nation's space-exploration and missiles programs. Other significant gains were made in laboratory production of high-purity tungsten and yttrium. Experimental work on hafnium moved rapidly toward development of a cheaper method for producing this metal for nuclear-reactor use.

As supplies of many commodities became more assured during the year, the Bureau turned attention to investigations of the properties of unusual minerals, uncovering new facts about such rare-earth metals as erbium, holmium, dysprosium, gadolinium, and neodymium. At the same time, research in light metals progressed with the Bureau beginning a commercial evaluation of its new electrolytic process for recovering high-purity titanium from scrap and other materials.

Conventional metals were not neglected, however. Research in steelmaking resulted in successful use of both natural gas and coal in the Bureau's experimental blast furnace, and other studies demonstrated that low-nickel austenitic stainless steel can be made from offgrade ores. Work advanced rapidly on the Bureau's segregating process for treating copper oxide and oxide-sulfide ores.

Studies of nonmetallic minerals included experiments with super-reactories which yielded new data on thermal decomposition of

cerium, lanthanum, and yttrium salts at temperatures up to 1,500° C., and new information was obtained on methods for upgrading clays to improve their refractory properties. Elemental boron was produced experimentally by several different techniques, and additional knowledge was gained on the structure of asbestos.

Mining research.—High-speed photography provided basic data on quarry blasting, and progress was made in physical studies of rock breakage by explosives. Information was published on methods and costs at stone quarries, mineral-aggregates mines, and natural mines. Studies aimed at utilizing submarginal deposits of phosphate rock were advanced and a new project was begun to evaluate the use of cavitation in breaking phosphate rock and other materials.

Studies of petroleum and natural gas.—Toward the end of the year, the Bureau completed its part in a long-range Departmental study to estimate future U.S. requirements of petroleum and natural gas, and to outline ways of assuring adequate supplies. In another cooperative project, radioactively "tagged" gas was injected into producing oil wells in the Spraberry Field of West Texas, as part of research to develop effective waterflooding techniques for large oil-bearing formation.

The possibility of using nuclear explosives as an aid in obtaining oil from the extensive oil-shale deposits of the West was discussed at a meeting with petroleum and chemical companies, whose response to the Government's proposal for a cooperative test was generally favorable.

The Bureau's petroleum and natural-gas studies resulted in several important achievements, including a method that employs foaming detergents to remove unwanted water from gas wells; a portable battery-powered radiation monitor that can be used to detect radiation in areas where no central power is available; and a new apparatus that makes possible use of the metal, gallium, to gain higher accuracy in recording characteristics of petroleum and natural gas.

A major accomplishment of studies in petroleum chemistry was the first actual identification of a nonbasic nitrogen compound from petroleum. The compound, dibenzopyrrole, was separated by gas chromatography and identified by mass and infrared spectroscopy.

Health and safety progress.—Advances in mine safety during the year included commercial manufacture of a Bureau-developed, portable mining face shield and development by Bureau research of a new methane-detecting device, small enough to be carried in a man's pocket and operated by one standard flashlight cell. At the same time, cooperative research by the Bureau and industry moved closer to obtaining a practical design for a continuous methane-

monitoring system with automatic power shutoff for electrical equipment operated in face areas of coal mines.

Production of safety-education films for mineral-industry workers was intensified during the year, and approximately 10,000 persons completed the Bureau's various accident-prevention courses. The Bureau's 246 coal-mine inspectors made nearly 12,000 routine and special inspections of the Nation's coal mines.

Helium.—Construction of a fifth Bureau of Mines helium plant at Keyes, Okla., designed to add 290 million cubic feet a year to the Government's helium-production capacity, was nearly completed at the fiscal year closed. The Bureau's Navajo helium plant, Shiprock, N. Mex. was shut down temporarily because of reduced supply of helium-bearing natural gas. However, a new source of helium was arranged and the plant was readied for return to production. Refinements were made in the Department's proposed helium-conservation program that would encourage private industry to install up to 12 plants to recover helium now being lost when it goes to fuel markets as a constituent of natural gas. Toward the end of the year, the Department renewed its request to Congress for enabling legislation that would establish a national helium-conservation program.

Progress in coal research.—New studies began during the year to evaluate the possibility of applying hydraulic methods in mining bituminous coal and to develop techniques for removing the explosive gas, methane, from coal beds in advance of mining. Considerable headway was made in an experiment being conducted by the Bureau and a coal company to determine whether a 30-foot seam of anthracite, pitching 25°, can be mined mechanically. The Bureau also continued its full-scale long wall-mining project to develop a highly productive mining system for anthracite beds of variable thickness and pitch.

Coal-preparation research was concentrated on improving methods for cleaning bituminous coal, especially the fine sizes that usually do not respond well to mechanical treatment, and on experiments to develop economic methods of calcining anthracite for use as a boiler fuel. Nuclear radiation also is being utilized in research on bituminous-coal and anthracite to gain more knowledge of their fundamental properties.

Research on producing synthetic liquid fuels from coal was marked by operation of an electrically simulated nuclear reactor as part of studies to learn whether atomic heat can be used for economic production of synthesis gas.

Explosives studies advanced.—Laboratory experiments yielded further knowledge of how gas can be ignited by improperly used

explosives, and a new apparatus was designed for studying combustion reactions under high pressures.

Foreign activities.—The Bureau continued to provide industry and Government with information on mineral development in other countries and, through a series of special studies, obtained realistic appraisals of production, trade, and mineral potential of Communist nations. Bureau specialists gave technological aid on mineral problems to 15 countries, and 25 foreign scientists and engineers received training at Bureau installations during the year.

Publications.—A noteworthy attainment in fiscal 1959 was the publication of seven volumes of the Minerals Yearbook, on which production had unavoidably fallen behind during World War II. In addition, the Bureau issued 337 other technical publications and produced some 260 articles for technical journals and scientific meetings.

The foregoing highlights only a few of the many activities of the Bureau of Mines during fiscal year 1959. Details regarding the Bureau's many other accomplishments during the year are found on the pages that follow.

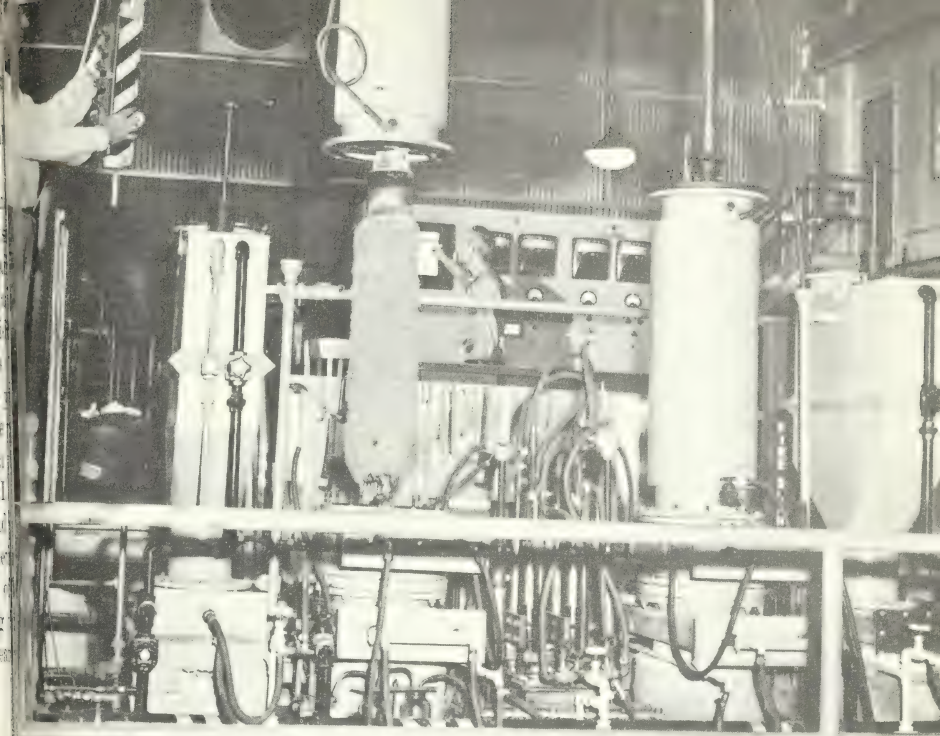
Minerals Development

Diminished demand for certain minerals and completion of new production capacity brought about an oversupply of many commodities during the year. As a result, the sense of urgency slackened in the free-world quest for assured mineral supplies, and attention shifted to developing unusual or little-known minerals, elements, and alloys. Increasing scientific knowledge revealed new vistas in the endless search for ways to advance his material well-being. But much work remains before scientific findings can be translated into useful practice.

Despite the abundant mineral supply, competition from other nations, now recovered from the impact of World War II, compelled American industry to strive for greater technologic efficiency to maintain its position in world markets.

During the 1959 fiscal year, the Bureau of Mines continued to give high priority to defense activities, providing essential information for the Department of the Interior's Office of Minerals Exploration. The Bureau staff also advised the General Services Administration on many matters concerning national defense.

Bureau scientists served on many committees and boards, including those of the American Society for Testing Materials; the American Institute of Mining, Metallurgical, and Petroleum Engineers; the National Academy of Sciences; the American Chemical Society; and the American Standards Association.



deposit of electrorefined titanium emerges from a cell at the Bureau's Boulder City, Nev., Metallurgy Research Center.

Construction began during the year on the Bureau's new research center at Fort Snelling, Minn.

Es: Metals

Field examinations of copper antimony, mercury, and tin deposits in Alaska and Washington progressed favorably, and reports were issued describing lode and placer tin deposits in Alaska. A Bureau study of mercury resources in the United States was nearly completed, and plans were formulated for publishing its findings. Method and cost studies at base-metal mines in Alaska, Arizona, Missouri, Montana, Nevada, New Mexico, Utah, and Washington were developed in reports issued during the year and a Materials Survey on mercury was published.

Progress was made in applied-physics research at open pit and underground copper mines; one such study in Michigan contributed to the development of a mining method that will nearly double the percentage of ore extraction.

Bureau study on noise abatement developed fundamental data for establishing methods of reducing and controlling noise in mining.

Another investigation disclosed that the use of precast concrete supports for mine openings shows great promise for solving ground support problems in deep mines.

Significant gains were attained in metallurgy. The Bureau began an evaluation on a semicommercial scale, of its segregation process for treating oxide and mixed oxide-sulfide ores of copper. Research on copper reverberatory-furnace slags yielded a method for recovering copper from furnace dust trapped in the precipitates.

Studies on recovering antimony and mercury from Alaskan iron-nabarstibnite ore by flotation and FluoSolids roasting were completed, and the results published, and research progressed on leaching mercury ore and concentrate and recovering finely divided lead and zinc sulfide minerals.

Research on secondary nonferrous metals advanced in refining cadmium and iron-contaminated zinc; recovering tin from hard lead and lead from battery plates; and vapor pressure, selective oxidation and distillation studies.

Under Bureau fellowships at the University of Arizona, research was completed on specific phases of leaching copper, lead, and iron minerals at elevated temperatures and pressures and on an experimental study of ore transport with scrapers.

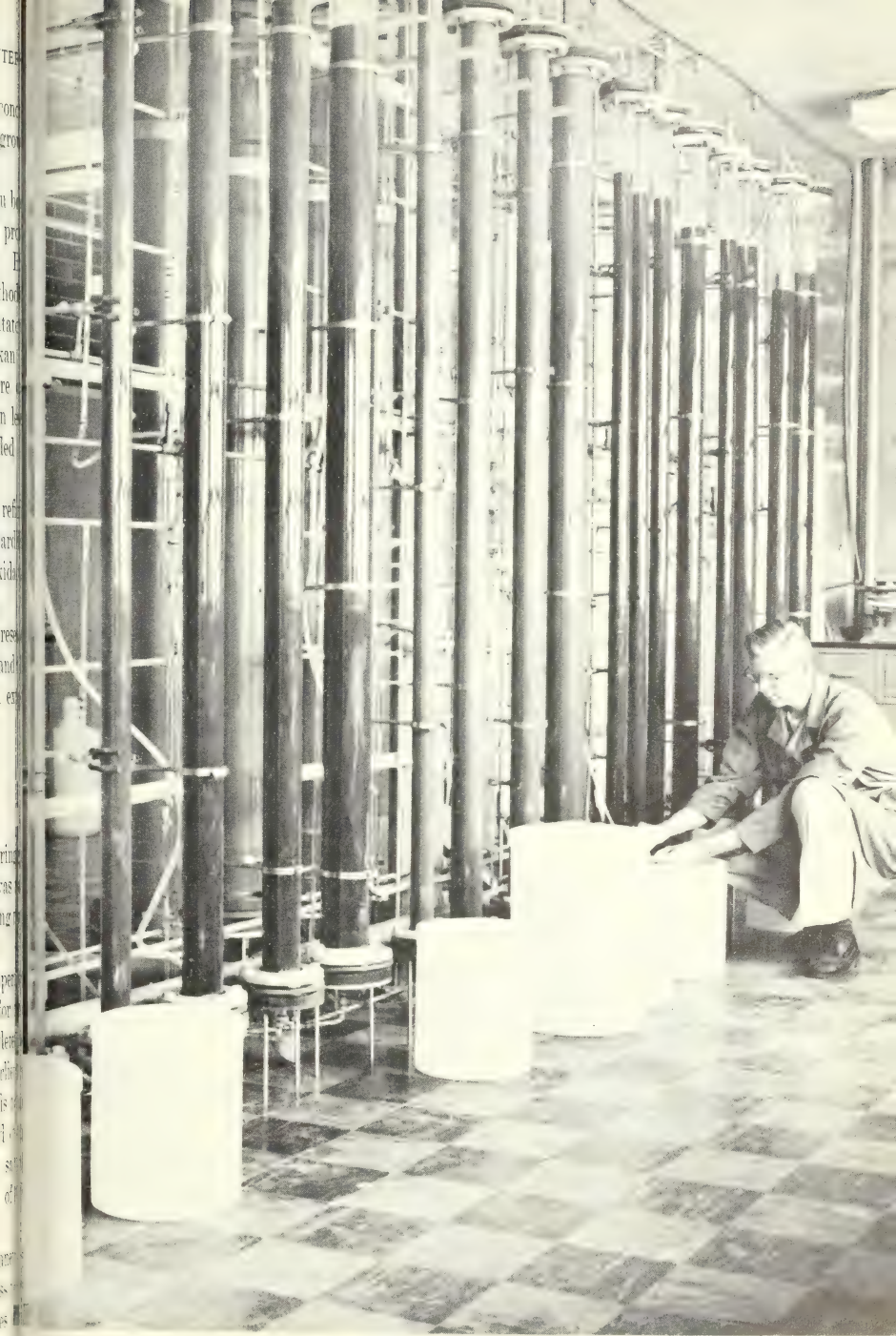
Ceramic and Fertilizer Materials

Bureau research on superrefractories was intensified during the year. The number of scientists engaged in this program was more than doubled, and new techniques were acquired for measuring properties of refractory oxides at high temperatures.

New equipment also was obtained including high-temperature X-ray diffraction and differential thermal analysis units for operating temperatures up to 1,500° C. and sonic equipment for detecting flaws in materials. A carbon-arc-image furnace acquired earlier was equipped with an iris diaphragm so that refractory materials could be grown under controlled temperatures. Data were collected on the thermal decomposition of cerium, lanthanum, and yttrium salts at temperatures up to 1,000° C. and on the physical properties of their derived oxides.

Underground tests with the Bureau's phosphate-rock plane disclosed a need for better cutting chisels. The second progress report on phosphate-rock mining research was published. Studies are now at utilizing submarginal phosphate rock were continued, and an investigation was begun of cavitation and its use in breaking phosphate rock and other ores.

Bureau studies to develop substitutes for strategic natural mica emphasized the determination and control of factors affecting



Creating ion-exchange columns, which are used in one of many approaches Bureau of Mines metallurgists are making to the problems encountered in separating closely associated metals.

the growth of large single crystals of synthetic mica, investigation of various compositions in the large family of synthetic fluormicas, and research on ways of converting flake synthetic mica to a commercial sheet material.

Synthetic minerals with water-swelling properties were distributed to industrial and Government laboratories for study. Ion-exchange properties and film-forming techniques were investigated for water-swelling synthetic fluormicas. The Bureau published information on the thermodynamic properties of synthetic fluorphlogopite mica. Reported results of a study of hardness in synthetic and natural micas. Certain physical properties of synthetic and natural micas were determined.

Bureau research on abrasive and hard materials centered mainly on synthesizing borides of tantalum, tungsten, chromium, and zirconium investigating their properties. A method was developed for coating graphite shapes with metallic chromium.

Other studies showed that most fire clays containing quartz pyrite in grains coarser than the accompanying clay could be upgraded to improve refractory properties.

An improved wet process was developed for extremely fine grinding of kaolin and similar materials.

Construction and Chemical Materials

Laboratory and pilot-plant research was conducted on recovering fluorine from submarginal sources. Data were accumulated on the effectiveness of defluorination methods and on methods for recovering fluorine in commercially useful compounds. Deposits of fluorite and barite ores were examined and metallurgical research advanced toward the development of efficient means for separating and beneficiating these minerals by flotation. A report was prepared on fluorine resources in Arizona, and mining methods and costs were studied at two major fluor spar mines.

Elemental boron was produced in the laboratory by fused-salt electrolysis, Kroll-type reduction, and bomb reduction, and basic studies of the crystal structure of boron were continued.

Sulfur resource-and-utilization surveys were made in several Eastern and Midwestern States, and research on decomposing of gypsum and pyrite to recover sulfur included the construction of a small FluoSolids reactor designed to provide better processing conditions.

Synthesis of fluoramphibole and other asbestiform minerals was investigated, and information on the physical structure and properties of asbestos was accumulated. Electron-microscope studies threw new light on the structure of asbestos. Three asbestos

sites in California were surveyed, and reconnaissance diamond drilling was done at two of these deposits. A Materials Survey on asbestos was published.

Information was compiled on mining methods and costs at stone quarries and mineral-aggregates mines, on cutting and polishing stone, and on the physics of rock breakage by explosives. Strain-propagation studies by the Bureau provided background data for developing blasting procedures in open-pit mines, and high-speed photography yielded new information on quarry blasting.

Substantial progress was made in developing special instruments and studies of the effects of blasting vibrations on structures near quarries.

Several silica deposits sampled in the Pacific Northwest proved high enough in quality to warrant studying their potential use in solving the industrial-silica supply problem in that area.

A survey of water supplies and requirements of the metallurgical industries provided information that will guide research on methods of removing or counteracting deleterious constituents in metallurgical processes. Research began on the effect of water impurities in flotation processes.

The Bureau cooperated with industry to improve methods for recovering spodumene from North Carolina pegmatites, the largest known domestic reserve of lithium-bearing minerals.

Nonferrous Metals and Ferroalloys

Bureau research emphasized development of techniques for preparing and analyzing high-purity, high-temperature metals such as tungsten, molybdenum, and vanadium. Research on utilization of mineral resources concentrated on taconite and other low-grade iron ores and on low-grade manganiferous materials.

An outstanding achievement was the successful experimental use of natural gas and coal in the Bureau's blast furnace. With these fuels metallurgical-coke requirements were reduced substantially, and pig-iron output per unit of fuel was increased. The novel method in which the gas and coal were introduced through a special set of tuyeres resulted in the added benefit of exceptionally smooth furnace operation.

Research in steelmaking demonstrated experimentally that low-carbon austenitic stainless steel can be made from offgrade ores. High-purity ingots of conventional chemical composition were produced. Additional data derived by physical-chemistry research were helpful in studying steelmaking processes. Surveys began on relatively



Among the significant metallurgical attainments in the Bureau of Mines was development of the first successful technique for shape casting of molybdenum at the Bureau's Albany, Oreg., station. Here a cast of molybdenum is ready for finishing.

new technologic practices, including vacuum-melting methods, applications, and capacities, and the use of ultra-high-strength steel.

A Bureau-wide manganese conference established that currently used technical-and-economic evaluation studies of processes proposed for utilizing low-grade domestic manganiferous materials are a guide to future research. The Batesville, Ark., manganiferous limestone deposit was reported as one of the five largest potential domestic sources of manganese.

Publications on manganese included a report on the manganese resources of Batesville; results of resources and metallurgical investigations of the Cuyuna Range manganese deposits of Minnesota; and research findings on an acid-ferrous sulfate-leaching method for treating low-grade manganese-carbonate and oxide ores.

Tungsten Research

A technique was developed for preparing 99.99-percent-purity tungsten. Research on methods for tungsten analysis was emphasized. In another important development, mechanical working of a sample of Bureau-prepared tungsten metal was demonstrated successfully. The metal was forged at 900° C. to a 75-percent reduction in thickness. Various methods for preparing high-purity metal were investigated including zone refining, electron-beam bombardment, carb reduction, hydrogen reduction of gaseous tungsten compounds, and electrolytic refining in fused-salt baths.

Nickel-cobalt technology advanced with development of an electrolytic method for separating nickel and cobalt from mixed carbonates of these metals produced in the U.S. Government-owned plant at Nicaro, Cuba. In addition, the Bureau developed and experimented with a solvent-extraction method for producing high-purity nickel and high-purity cobalt from intermediate Nicaro products.

Successful Bureau experiments in shape-casting molybdenum attracted widespread attention from industry. This activity and that of preparing molybdenum-base alloys are part of Bureau research in high-temperature materials.

An exceptionally high size reduction of vanadium by cold-working was achieved by using small quantities of yttrium to remove impurities. Vanadium metal thus treated was cold-rolled to 0.007 inch.

Research on analytical methods led to a significant advance in identification of minute solids. The technique used a fluorescent ray spectrographic probe made by the Bureau to determine the elements in seams or inclusions as small as 0.01 inch.

Bureau work indicated that it is technically feasible to produce carbon ferrochromium from subgrade chromite concentrate in a two-stage smelting operation.

Light Metals

A preliminary examination and metallurgical testing program on sauxite deposits of Hawaii was completed by the Bureau, and a report describing the investigation was placed in open file. No

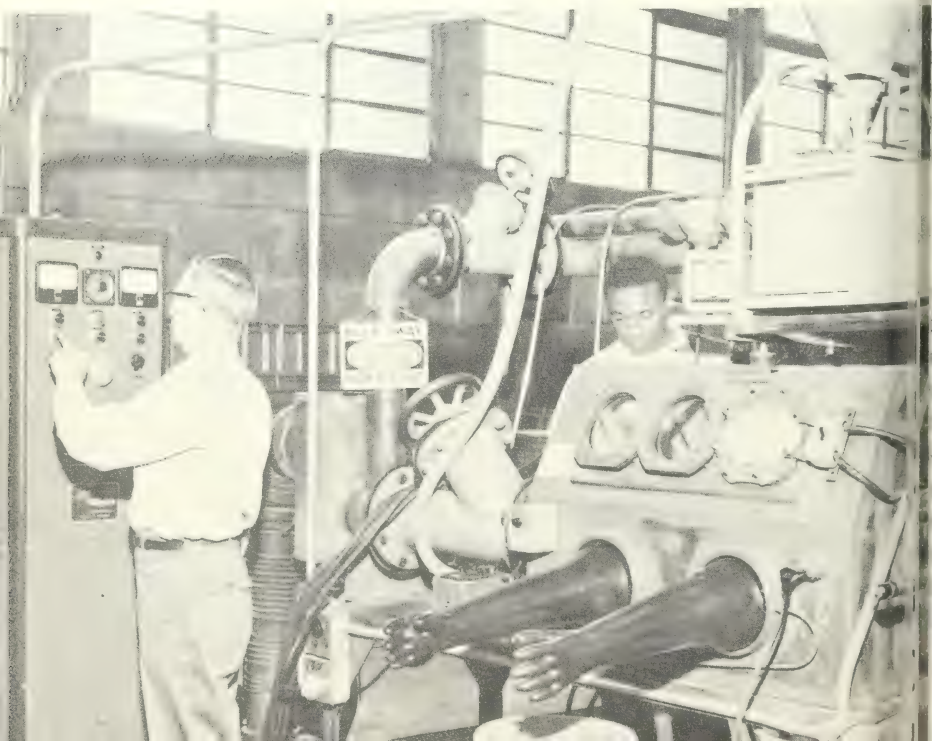
products were obtained that could be considered economically competitive with those from commercial bauxite deposits. Further investigations were planned by the Bureau and the Geological Survey of the Department of the Interior in cooperation with Hawthorne. Additional samples have been collected and forwarded to the Bureau's Rolla, Mo., Metallurgy Research Center where extraction and concentration characteristics of the bauxites will be tested.

The Bureau also studied the high-iron bauxites of Oregon this year. Use of the double-leach method for extracting alumina yielded recoveries as high as 90 percent from these materials.

New information on the binary alloys of hafnium with nickel and iron were developed by Bureau research. Laboratory tests employing sodium and magnesium mixtures for reducing hafnium tetrachlorides have shown great promise for producing cheaper hafnium metal for nuclear reactor use.

A new method was developed for separating tantalum from columbium through halogen exchanges, and chlorination techniques were perfected for extracting columbium, tantalum, and other rare metals from domestic euxenite ore. A new electron-bombardment furnace was used for making ultrapure columbium, tantalum, zirconium, hafnium, yttrium, beryllium, and other high-temperature metals.

Carefully controlled conditions surround operation of this cerium electrolytic winning cell at the Reno, Nev., Metallurgy Research Center.



A process suitable for commercial exploitation was developed for recovering thorium from thorite ore, and new analytical methods for uranium and rubidium were explored that will greatly facilitate future research on these two metals.

Research by the Bureau for domestic sources of beryl and its recovery stimulated private industry to seek new sources of beryllium. A flotation process was developed on a laboratory scale that will permit recovery of beryl as a byproduct of spodumene mining at Kings Mountain, N.C., and work on a larger scale is planned. Substantial progress also was made in developing techniques for producing high-purity beryllium needed as a structural material in aircraft and space vehicles.

The Bureau developed a process and devised equipment to recover magnesium and cadmium from a large surplus stock of demilitarized magnesium-cadmium bomb bodies held in Government storage at the close of World War II. A report was published by the Bureau on this work.

Two Bureau publications described chlorinating methods developed for creating domestic low-grade titaniferous materials.

The Bureau began operating a 10,000-ampere electrolytic cell to evaluate the commercial feasibility of its process for recovering titanium from titanium scrap and other titanium materials. The process, a cooperative undertaking with GSA, has produced 100 pounds of high-purity titanium metal per day from a low-grade titanium metal feed.

Commercial manufacture of titanium valves is a direct outgrowth of casting studies conducted by the Bureau at Albany, Oreg. The Bureau developed a technique for casting this strong, corrosion-resistant metal, and demonstrated to industry that sound titanium valves can be made.

Rare and Precious Metals

Consumable-electrode arc-melting processes developed by the Bureau for zirconium have been adopted by private industry, and are now being used in producing other high-purity metals, including high-purity hafnium, thorium, tantalum, and columbium.

Taking an important step toward utilization of the rare-earth metals, the Bureau has separated oxides of erbium, holmium, dysprosium, gadolinium, neodymium, praseodymium, and yttrium to purity in excess of 99.95 percent; work also continued on separation and purification of individual rare-earth elements. By removing gaseous impurities, yttrium metal much more ductile than ordinary commercial yttrium was produced.



Scientists at the Bureau's Albany, Oreg., research center examine a piece of high-purity yttrium metal. By finding a way to remove most impurities, the Bureau has increased yttrium's ductility, making it a potential construction material for missiles and space probes.

The Bureau began expanding research in nuclear technology, including the utilization of nuclear phenomena for research in metallurgy, the metallurgy of depleted uranium as an alloying



Bureau of Mines engineer scans uranium ore with a Geiger counter.

student, the preparation of electrolytic uranium, and the study of radioactive-waste disposal.

Foreign Activities

Bureau interest in foreign minerals arises from the fact that markets for most minerals and progress in technology are international in scope. Mineral developments in other parts of the world, there-

fore, vitally affect domestic producers, exporters, and consumers of minerals; domestic manufacturers of mining supplies that export abroad; and investors seeking profitable employment of capital in foreign mineral enterprises. They are no less essential to commercial and research specialists and officials coping with problems of mineral policy and supply in peace and war. To meet these needs, the Bureau's foreign activities featured the collection, analysis and interpretation, and distribution of mineral information obtained from all corners of the earth.

The Bureau relied heavily on the Department of State and the United Nations for information; during the fiscal year over 3600 information dispatches were received from the former and nearly 20,000 from the latter.

Rapid expansion of mineral production in Communist countries and the appearance of Soviet minerals on world markets stimulated numerous inquiries to the Bureau, including several from members of Congress. Six special reports were prepared and published by the Bureau and other periodicals. The paucity of statistics from Communist areas required Bureau area specialists to review voluminous scientific and technical literature in the Russian and Chinese languages to obtain realistic appraisals of Communist production and trade.

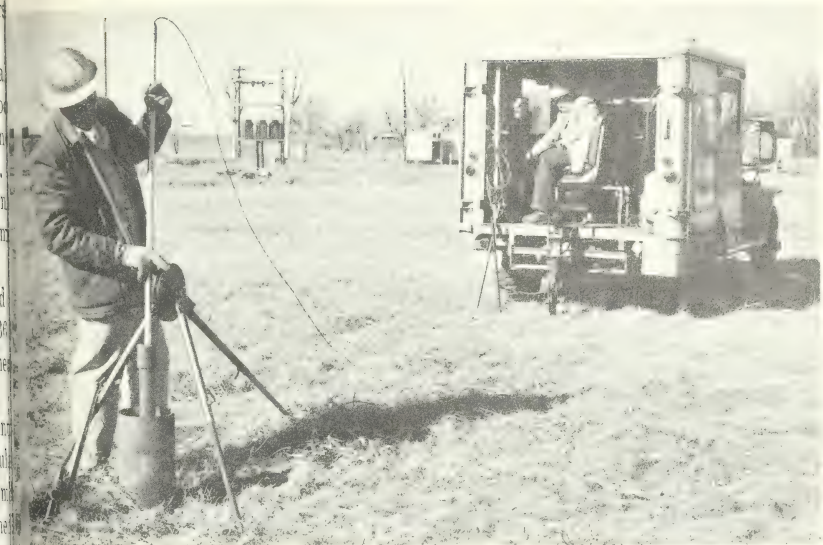
From these studies, the Bureau concluded that industrial expansion in the Soviet bloc and Communist China is supported by mineral resources adequate for any industrial output these nations are capable of organizing and managing. Continued surveillance of mineral developments in this part of the world occupies high priority in the Bureau's future plans for foreign activities.

In collaboration with the International Cooperation Administration, the Bureau maintained 13 senior technologists on technical assistance assignments in 11 countries. These specialists were stationed in Afghanistan, Brazil, Colombia, Cuba, Indonesia, Israel, Mexico, Nepal, Pakistan, Peru, and the Philippine Islands.

Short-term assignments of seven technologists, chiefly on special detail, were completed in India, Israel, Mexico, and Panama.

Substantial services in the form of laboratory assistance and technical consultation were extended to mineral experts employed directly by ICA.

The training of foreign technical personnel at Bureau installations continued to yield favorable results. The number increased during fiscal 1959, and 25 completed their assignments in the Bureau. They represented Afghanistan, Bolivia, Chile, Colombia, Cuba, Formosa, India, Indonesia, Korea, Mexico, Peru, Philippines, Spain, Thailand, and Yugoslavia. Training in the fields of mining, metallurgy, and



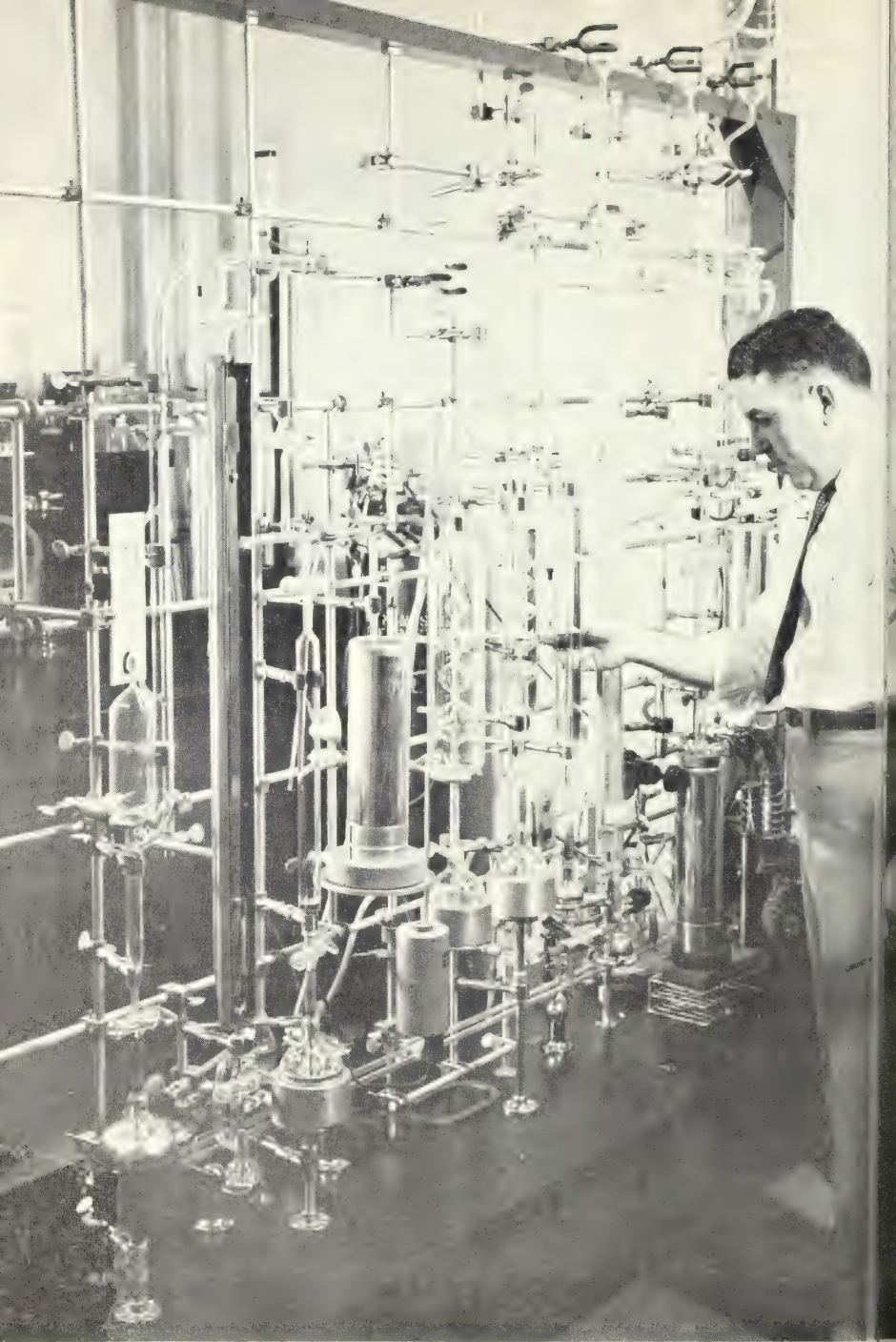
bing the earth's interior, Bureau of Mines petroleum researchers start gamma-ray logging device down its long journey in an oil well. Instruments in truck record findings.

al dressing, utilization and preparation of fuels, mineral analysis, health and safety practices was featured. At the end of the year 14 foreign visitors were in training status with the Bureau.

Petroleum and Natural Gas

The petroleum staff of the Bureau spent considerable time on a long-range report which the Office of Civil and Defense Mobilization requested from the various agencies of the Department of the Interior. This long-range study develops factual background on requirements for petroleum and estimates what they will be in 1960, 1965, and 1975. Ways to meet the requirements were studied and evaluated for national-security planning. Various cases were assigned to the Office of Oil and Gas, the Bureau of Mines, and the Geological Survey—all constituent bureaus of the Department of the Interior. Many oil companies supplied data for the study. The Bureau report was completed near the end of the fiscal year.

The Bureau of Mines and Atomic Energy Commission are cooperating to explore the feasibility of using nuclear explosives in mineral development. At a meeting with the petroleum and chemical industries to consider the use of a nuclear explosive in oil shale,



This complex array is a low-temperature gas adsorption apparatus set up in connection with oil-shale studies at the Laramie Petroleum Research Center.

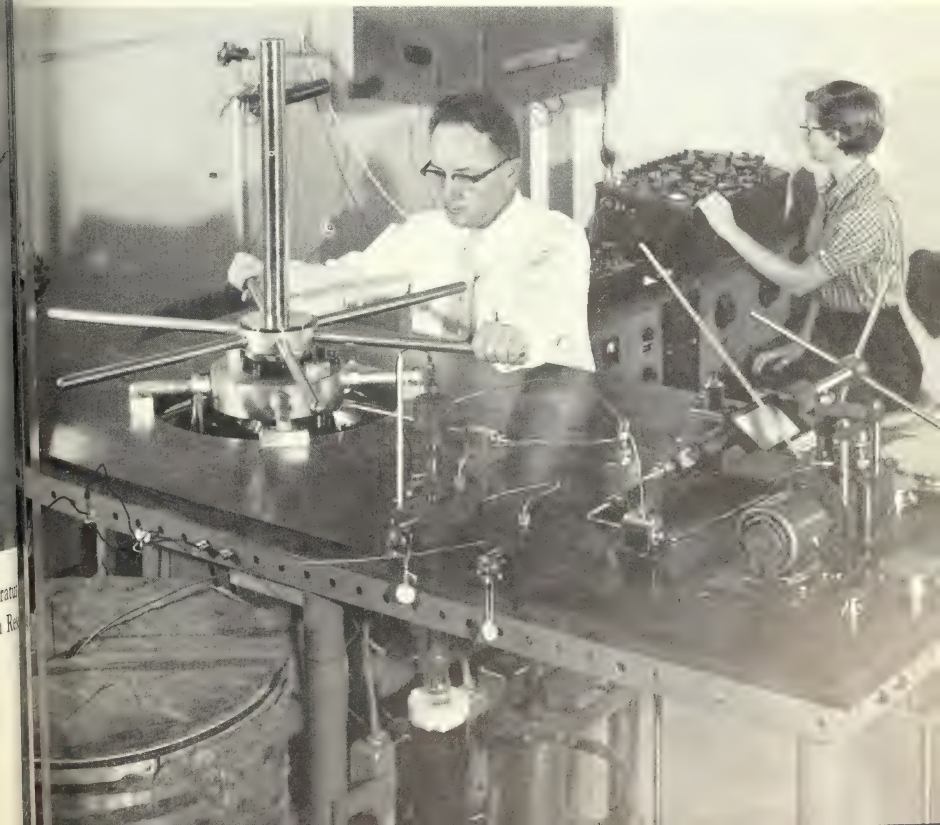
dustry response to the Federal Government's proposed experiment as generally favorable, and plans were formulated to conduct test.

Publication of volume 2 of Monograph 10 on phase relations of s-condensate fluids completed a Bureau study of the properties of these fluids, in cooperation with the American Gas Association.

A report was completed on a rapid method for predicting performance of oil and gas-producing reservoirs by gas drive. The theory that makes the method possible was described, and detailed directions and related numerical values were given for three specific examples of predicting reservoir performance. More accurate evaluation of the performance of any reservoir, with any combination of permeabilities and water and oil saturation, may be obtained than was possible previously. A computer program for the method was prepared.

A cooperative project in the Spraberry Field in West Texas is contemplated. Preliminary injection of "radioactive-tagged" gas

water accuracy in recording the characteristics of natural gas and other hydrocarbons under pressure became possible when the Bureau of Mines developed this new apparatus which employs liquid gallium metal to refine the samples studied.



in producing wells of this field, arranged to gain knowledge of oil-bearing formation, is permitting the most economical and effective location and spacing of wells for waterflooding. The large petroleum reserves of the Spraberry-trend area were not highly productive until the recent application of new waterflooding techniques.

Oil recovery by in situ combustion was studied by the Bureau for possible application in the Appalachian area. Apparatus and procedure were developed to test various external sealants and to determine thermal gradients.

Knowledge of properties of compounds in crude oil that cause the oil to cling to reservoir rocks was advanced by new ultracentrifuge procedures and X-ray analytical methods. New instrumental methods were developed for determining trace constituents of oil and brines.

Field Tests Successful

An effective and inexpensive method was tested for removing water from low-pressure gas wells with a detergent-formed foam. The method was successful in 34 or 38 field tests.

A study was begun to develop fundamental data on two-phase flow of gas-liquid mixtures in vertical tubes. The technique of flow to be established would be applicable for reducing the cost and energy expended to lift fluids from underground formations.

A summary report was completed on an analysis of cores from a well in the Umiat field in northern Alaska. No background experience was available for predicting the performance of this unusual reservoir, and laboratory work thus was undertaken to aid the study.

A manuscript, *Petroleum and Natural Gas Fields in Wyoming*, was completed for publication. Producing fields of the State are discussed, and analyses are presented for 418 crude oils from Wyoming fields.

Thirty-nine reports on the many phases of current oil-production research were prepared for publication.

Projects advocated for continuation and amplification include: (1) Studies of surface-activity of reservoir fluids and rocks; (2) oilfield brines and water problems; (3) behavior of hydrocarbon fluids in reservoirs, and (4) productivity of oil and gas wells, especially the rate of productivity in relation to estimated reserves. Such information would improve the accuracy of forecasts of petroleum reserves and availability.

New petroleum studies being considered include: (1) Use of nuclear energy to produce oil from reservoirs that cannot be



et of foam sprays from a wellhead during field tests of a technique
 used by Bureau of Mines petroleum engineers for removing water
 from a natural-gas wells with a column of detergent-generated foam.



Field tests help Bureau of Mines petroleum engineers develop improved
 oil production methods.



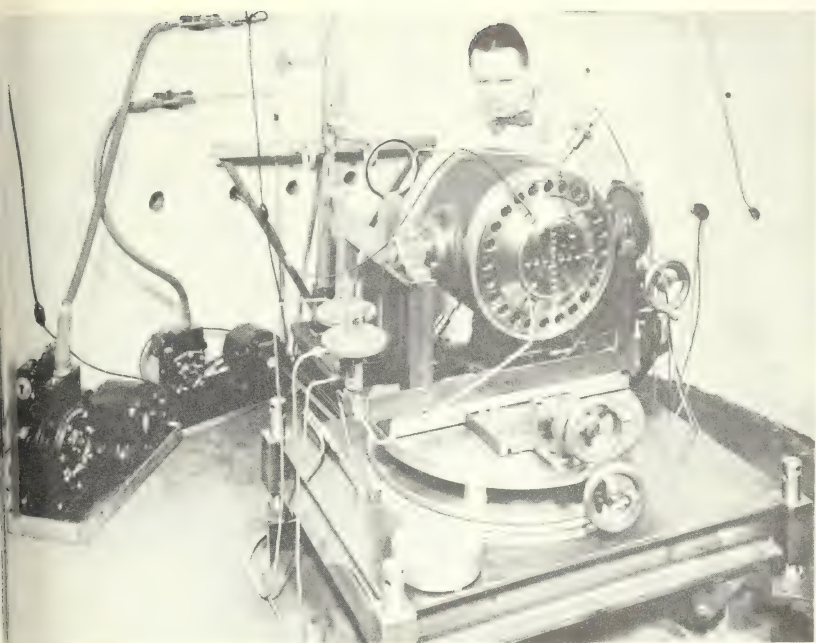
Typical mobile equipment used by the Bureau of Mines in subsurface sampling of an oil well in the Rocky Mountains area.

moved by present methods; (2) development of new gaseous tracers to follow the course of fluids underground; (3) disposal of radioactive wastes in subsurface strata; and (4) basic research in the new methods of production (in situ combustion).

Chemistry, Thermodynamics and Refining

Identification of carbazole, (dibenzopyrrole), in Wilmington, Calif., petroleum was a major accomplishment by the Bureau. This is the first actual identification of a nonbasic nitrogen compound from petroleum. The carbazole was separated by gas chromatography and was identified by mass and infrared spectroscopic comparisons with a purified sample.

Research on missile fuels was aided greatly by the first determination of the nitrogen-fluorine bond energy in organic compounds. Completing and testing a pressure-volume-temperature apparatus using gallium instead of mercury as the containing fluid was an important contribution to experimental techniques in this field. Gallium is superior to mercury for determining compressibilities of gases because it permits determinations of higher accuracy over a wider range of temperature.



Developed by Bureau researchers at Pittsburgh, Pa., this apparatus permits closeup studies of flame characteristics in exploding gas mixtures under high pressures encountered in certain military and industrial operations.

Progress was made in studies of air pollution by development of equipment and techniques for analyzing automobile-exhaust gases. This resulted in identification of 20 more compounds in a particular exhaust gas than had been possible previously.

The Bureau proposes to extend the studies to include the effect of atmospheric exposure on the composition of exhaust gases, relating the final composition back to fuel type and engine operating conditions.

Radioactive Tagging

Radioactive tagging of gasoline components was employed to solve the problem of deterioration of liquid fuels in storage and in determining what materials enter into formation of gum and what reactions are involved. Sixteen pure hydrocarbon compounds were tagged with tritium, a radioactive form of hydrogen. Separate studies of each compound with gasolines will be tested in storage conditions that promote gum formation. The course of the radio-

active components, to fuel or to gum, will be determined by "counting" techniques.

Three organic sulfur compounds and two organic nitrogen compounds were purified for determination of thermodynamic properties.

Seven additional sulfur compounds were identified in Wasmuth, Tex., crude oil, including two homologs of thiophene. These identifications of homologs of thiophene in crude oil open an entirely new field of sulfur-compound research of immediate and potential value to petroleum refiners.

In a study of fuel availability, fuels corresponding to jet fuels JP-4, JP-5, and JP-6, rocket fuel JP-1, and a low-volatility fuel were prepared from 15 crude oils and were analyzed.

Bureau of Mines routine analyses of 226 domestic crude oils were completed.

Five petroleum-product survey reports were published, comprising two reports giving inspection data on motor gasoline and petroleum each on aviation, diesel, and burner fuels.

In a cooperative study of stability of distillate fuels in storage, a report was made to the Bureau of Ships on separation of paraffin materials from test fuels and on the oxidation of pure hydrocarbons.

Detailed analysis of raw materials and products is the principal area of research the Bureau feels should receive more attention. Analysis of trace components is important. Modern engines subject petroleum products to severe conditions, increasing the harmful effects of certain trace components. The Bureau looks forward to expanded use of modern instruments and radioactive tracers. More precise and accurate analytical methods are necessary for that portion of petroleum from which jet, turbine, and diesel fuels are obtained. Preparation and purification of hydrocarbons for use as analytical and thermodynamic standards is an urgent need. The relationships of petroleum fuels and the engines in which they are used should be amplified. These areas of research reflect the need for more detailed analyses of crude oil and its products.

Petroleum and Natural Gas Economics

The growth of oil production and consumption around the world has important effects on the petroleum industry in the United States. To provide better information on these developments, the Bureau of Mines began expanding the coverage and increasing the usefulness of its monthly publication, *World Petroleum Statistics*.

The effect of foreign petroleum on the U.S. oil industry resulting from mandatory controls being placed on oil imports in March 1959

level of crude-oil and finished-product imports allowed under these controls is computed according to Bureau forecasts of petroleum demand.

Shale Research

Bureau of Mines Fischer assays were made on 10 additional cores of oil-shale formations in Colorado and Utah and on samples of foreign oil shales collected in previous years. The data on Colorado and Utah deposits will be useful for estimating the potential oil reserves of the Rocky Mountain region.

A method for concentrating the kerogen of Colorado oil shale, which includes selective wetting of the organic and inorganic constituents, yielded 7 pounds of unaltered concentrate, which will be useful in future research into the constitution of kerogen.

Nearly 1,700 X-ray diffraction and X-ray fluorescence analyses and photomicrographs were made on shale samples and related materials.

Seventeen reports on oil shale and shale oil were published or prepared for publication.

Health and Safety Activities

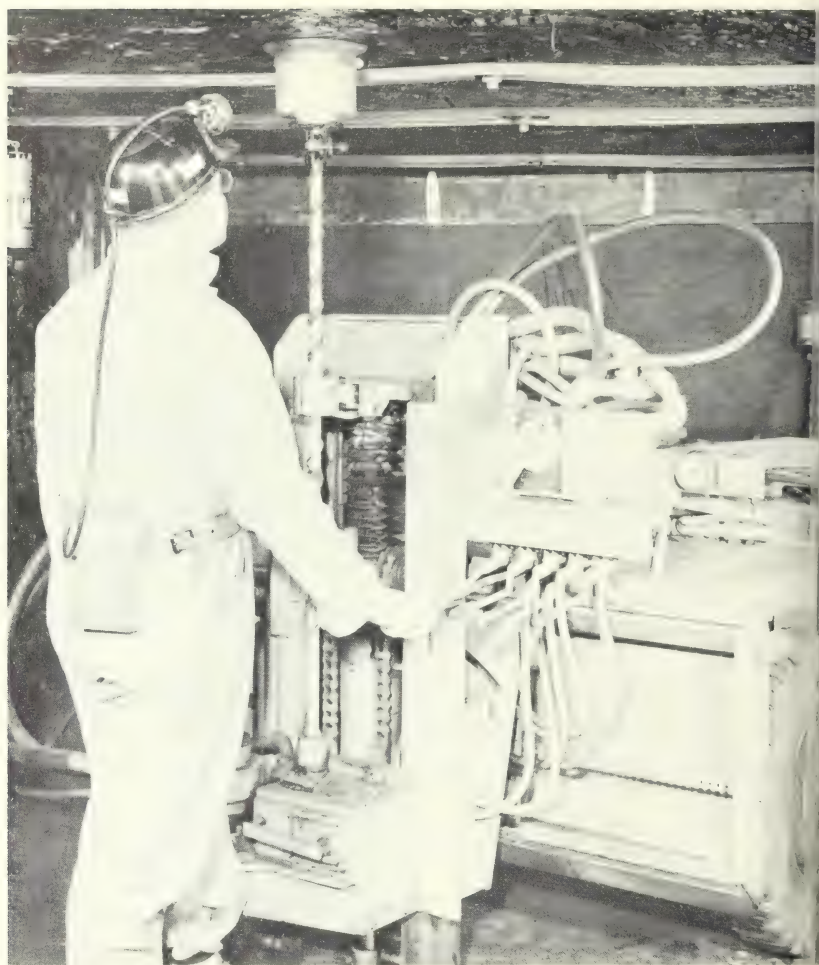
The trend in mechanization of the mineral industries continued unabated during fiscal year 1959. Advances were particularly notable in the adoption of continuous mining systems and related machines and appliances. Because of rapid changes in electric-powered machines and devices, the Bureau permitted experimental installations under appropriate regulatory safeguards.

Considerable progress was made towards solving the problem of adequate face ventilation in gassy coal mines operated by continuous mining systems.

The search for better methods of controlling mine roof continued during the year, including the application of sonic methods to predict mass movements and cementation of rock strata by injecting soluble resins into planes of weakness.

In pooling the technical resources of the Bureau and mining-equipment manufacturers, the date for producing an acceptable, reliable, continuous, methane-monitoring device with automatic power shut-off for equipment used in face areas of gassy coal mines appeared closer to realization.

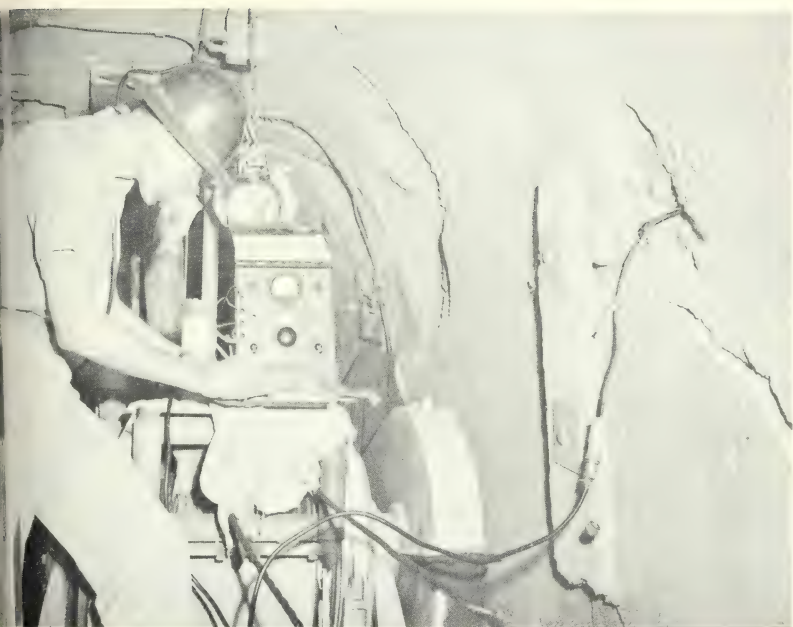
The Bureau in cooperation with the Public Health Service accelerated its studies in western metal mines to establish safe tolerances



A rotary drill with dust collector approved by the Bureau of Mines for vertical drilling.

for various atmospheric contaminants and to develop proper respiratory-protective equipment for workmen.

Studies were continued to develop safeguards against mine disasters, especially those resulting from explosions and fires. By coal-mine inspections, and safety investigations in coal and non-ferrous mines, and by encouraging participation in its accident-prevention educational program, the Bureau worked to promote safety throughout the mineral industries. Unfortunately, five major disasters occurred during the fiscal year—four in coal mines, killing 57 men and one in an iron-ore mine, killing 6 men.



Bureau of Mines researcher takes measurements of rock movements in large underground copper mine in Arizona.

Work on Primary Hazards

Falls of roof, rib, and face caused 56 percent of the underground mine fatalities in 1958 compared with 54 percent in 1957, though there were actually 41 fewer deaths from this cause in 1958. The occurrence of fatal accidents occurring within 25 feet of the working face—the most dangerous zone—dropped slightly. This indicates some progress in preventive measures.

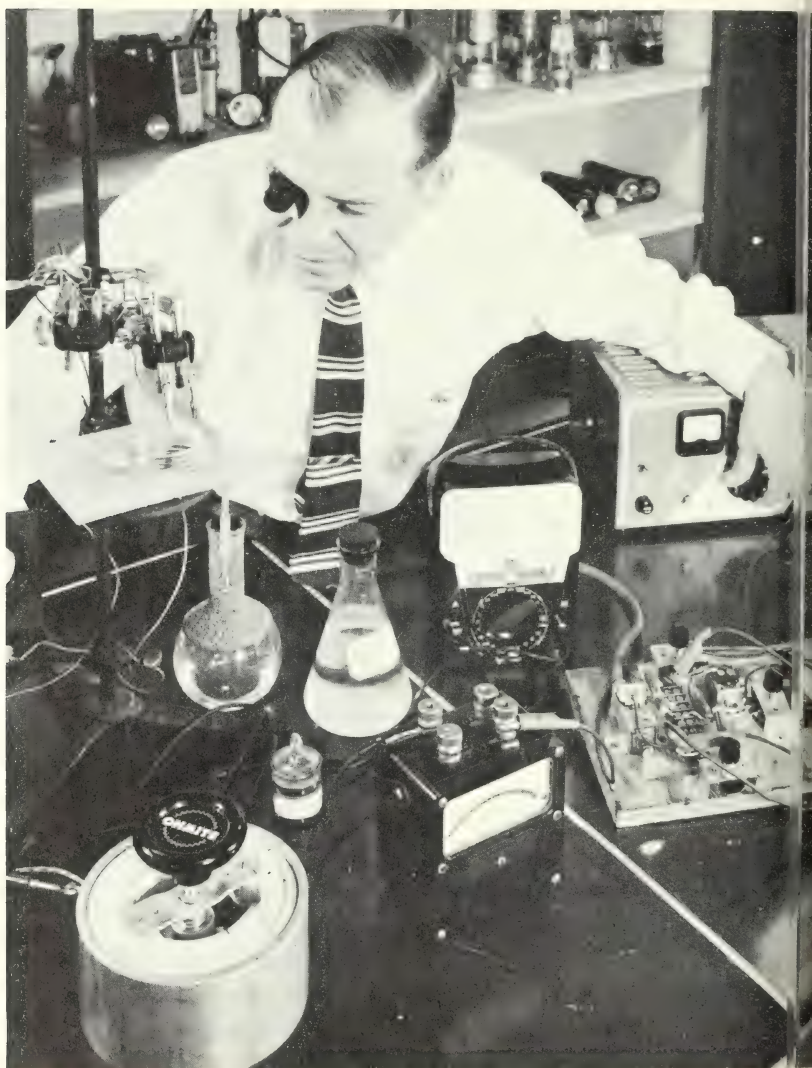
The Bureau undertook new experiments in electronics (sonar-wave reflection) to determine structural conditions of mine roof. The method appears promising.

A Bureau-developed portable mining face shield was manufactured for the mining industry.

Rock-bonding experiments in coal mines continued with particular emphasis on cost reduction of bonding agents.

A uniform method for testing the effectiveness of roof-bolt anchorage was being established.

Cooperative research to develop a continuous methane-monitoring system with automatic power shutoff for electric-powered equipment operated in face areas of gassy coal mines moved steadily ahead during the year. Under Bureau leadership, one company built a



A Bureau of Mines scientist operates an experimental setup at the Central Experiment Station as one step in seeking a continuous methane monitoring device to warn of gas in coal mines.

continuous methane-monitoring device which is activated by a power-cutoff device developed by another company.

Bureau research to develop longer-lived electric filaments at the heart of most methane detectors—produced a new methane-detecting device, small enough to be carried in a man's shirt pocket, and powered by one standard flashlight cell. Research continued at the Bureau's Experimental Coal Mine, seeking a solution to the problem

face ventilation where continuous-mining machines are used. All data were collected in operating coal mines in Pennsylvania and West Virginia to supplement experimental results. Problems in operating multiple main fans for ventilating bituminous coal mines were investigated. Fan characteristics were studied and evaluated and recommendations prepared and disseminated to the industry through Bureau publications.

Testing Equipment

As mechanization of coal mines continued to increase, the Bureau's workload of testing mining equipment for permissibility increased correspondingly.

During the year 114 new approvals were issued for electric- or gas-powered equipment under 12 testing schedules. Approvals included 3 conventional mining machines, 20 continuous miners, 9 conventional loading machines, 19 shuttle cars, 2 rock-dusting machines, 15 conveyors, 13 drills and drilling machines, 6 distribution systems, 1 dry-cell handlamp, 3 cap blasting units, 2 air compressors, 1 pump machine, 3 roof bolters, and 1 hydraulic-power unit. In

the case of subsidence created by block-caving methods employed at an underground copper mine is measured by a Bureau of Mines engineer.



addition, 1 diesel shovel, 2 diesel trucks, and 1 diesel locomotive tested and approved for underground use in noncoal mines.

The Bureau also issued 115 extensions of approval, explosion-tested 78 compartments, conducted 2,716 explosion tests in natural gas mixtures, and flame-tested 72 cables. Forty-six conveyor belts accepted for listing as flame resistant.

Nine new approvals were issued for drill-dust collectors for mines, and eight extensions were granted.

The Bureau's permissibility for multiple-shot blasting units was revised to permit approval of units that fire up to 20 short-circuit detonators instead of 10 as previously approved. The schedule covering lighting equipment for underground workings also was revised during the year.

Five new approvals were issued for respiratory-protective equipment, and 88 extensions were granted.

The Bureau's schedule covering nonemergency (chemical cartridge) gas respirators was revised to include paintspray respirators and published tentatively in the Federal Register.

Health

The Bureau's program to promote healthful working conditions in the mineral industries was carried forward through work on gases, dusts, and respiratory protection.

Approximately 19,000 gas samples were analyzed during the year, most of which were collected by Federal coal-mine inspectors. Samples analyzed were from sealed fire areas in coal mines, surface outcrop fires, metal and salt mines, tunnels under construction, tests of diesel-powered equipment, tests of respiratory-protective equipment, and miscellaneous field studies and laboratory investigations.

Field studies were conducted on toxic gases produced by blasting with ammonium nitrate-fuel oil mixtures.

The Bureau's survey of working environments in western coal mines, begun in 1958, was intensified during the year. More than 900 samples of dust and dust-source materials were examined by microprojection, X-ray diffraction, emission spectrometry, or other analytical methods to determine dust concentration, particle size distribution, or chemical composition for evaluating the presence of harmful radioactive and siliceous constituents. Dust production and dust-control methods were studied in four coal mines.

To develop performance requirements and test procedures for evaluating respirators to protect against radioactive particles, studies were made of methods for producing aerosols of submicron size.

literature on aerosol filtration was reviewed and analyzed for applicability to the respiratory-protection problem.

Operating characteristics of self-contained oxygen-breathing apparatus were studied to determine whether such equipment may be used safely in air pressures exceeding ordinary atmospheric, such as those in underwater tunneling or caisson work under compressed

Safety Education

Stepped-up production of safety-education films for use in safety training classes and introduction of a new course in fundamentals of coal-mine accident prevention keynoted the Bureau's progress in promoting safety training during the year. Bureau safety films were viewed by approximately 102,000 mineral-industry workers.

Approximately 10,000 persons completed the Bureau's various accident-prevention courses, bringing the total of those trained since 1910 to 234,000, of whom 218,000 completed the coal-mine accident-prevention courses.

Emphasis continued on 100-percent participation, as Bureau records show the greatest improvement in safety is made at mines and plants where every official and workman has received training.

Approximately 34,700 persons completed first-aid and mine rescue training during the year. Since 1910 nearly 2 million workers have completed the Bureau's first-aid course, and 118,000 have taken its mine rescue courses. The Bureau sponsored and furnished officials and judges for local, State, and national first-aid and mine rescue contests and sponsored the Holmes Safety Association, a national organization dedicated to the prevention of coal-mine injuries.

Bureau representatives investigated dust explosions in industrial plants and provided leadership and assistance in preparing national codes and standards to prevent such disasters.

Accident Analysis

Analysis of injury and related employment data continued to provide a guide for developing better programs to prevent accidents in the mineral industries.

Annual canvasses were conducted to obtain injury and employment information in the mineral industries, including coal mining, rock manufacturing, peat mining, quarrying, metal mining, non-metallic-mineral mining, sand and gravel operations, slag plants, metallurgical plants, and petroleum and natural-gas production and

refining. The Bureau publishes severity as well as frequency for coal mining, metal mining, nonmetallic-mineral mining, and petroleum and natural gas industries.

Approximately 1,000 mines, quarries, and plants participated in the 34th National Safety Competition sponsored by the Bureau. Certificates of Accomplishment in Safety were presented to approximately 2,000 workmen and supervisors at winning plants.

Control of Fires in Inactive Coal Deposits

Under Bureau guidance, 68 of the 190 known fires in inactive coal deposits had been extinguished or controlled by the end of the year. 38 were on the public domain and 30 on private property. An estimated 298 million tons of coal has been conserved under this program since fiscal year 1949 when funds for this purpose were appropriated.

During the year, seven fire-control projects were completed—four on public lands and three on private property. Work was in progress or being scheduled for nine other fires—four on the public domain and five on private property.

New projects will be started in order of urgency and as appropriations permit. Necessary maintenance work is done on completed projects so that the fires will not break out again. The Government pays the full cost of controlling fires on Federal land but not more than half the cost if the fires are on private property.

Coal-Mine Inspection

Fiscal 1959 saw completion of the seventh full year of Bureau activities under the Federal Coal Mine Safety Act.

The act consists of Title I, authorizing the Bureau to enter and inspect coal mines, report on hazards, and recommend their correction; and Title II, embracing specific enforcement provisions designed to prevent explosions, fires, inundations, and man-trip and man-hoist accidents in mines regularly employing 15 men or more underground.

More than 10,700 coal mines operated throughout the Nation during the year, including 1,338 Title II mines, 7,511 Title I underground mines, and 199 auger mines and 1,664 strip mines classified as Title I mines. At the end of the year, Bureau personnel assigned to coal-mine inspection and related duties included 24 coal-mine inspectors, 11 engineers, and 11 coal-mine electricians and inspectors.

During the year these employees made 2,972 routine inspections of the II coal mines; 35 of these inspections were made jointly with the inspectors under State-Bureau cooperative agreements as provided in the Act. In addition, 935 special inspections were made to determine whether previously cited violations of mandatory provisions had been abated.

Federal inspectors noted 7,167 violations of the mandatory safety provisions, many of which were corrected immediately and thus required no formal action.

They issued 1,105 notices allowing a reasonable time for abating violations, 169 time extensions, and 1,050 certifications that the cited violations had been totally abated.

During the year 98 orders were issued requiring withdrawal of workers from all or part of 70 mines—60 orders at 51 mines because of imminent danger and 38 orders at 19 mines because of failure to correct violations within a reasonable time. By comparison, 82 withdrawal orders were issued at 57 mines in fiscal year 1958.

Orders were issued classing 10 mines as gassy, which previously had been classed as nongassy. In fiscal year 1959, no appeals were made to the Federal Coal Mine Safety Board of Review—an independent, quasi-judicial tribunal—but the U.S. Court of Appeals for the Third Circuit affirmed the Board's denial of an application for annulment of a gassy-classification order in response to an appeal by a coal-mine operator filed in fiscal year 1958.

Federal inspectors and engineers also made 8,015 routine inspections of Title I mines (including 1,160 at strip mines and 188 at underground mines); 731 electrical, ventilation, dust, blasting, and related surveys; and 507 investigations of fatal and serious nonfatal accidents, mine fires, gas and dust ignitions, and miscellaneous conditions.

Four major disasters (single accidents causing five deaths or more) occurred during the fiscal year—three were mine explosions and one resulted from a sudden inrush of water into a mine from a surface opening.

Preliminary reports show 356 coal-mine fatalities in calendar year 1958, compared with 477 in 1957. The fatality-frequency rate per million man-hours of exposure decreased from 1.17 to 1.12 in 1958. The fatality-frequency rate for the first 5 months of 1959 was 0.91.

Helium

Assurance that helium would be available for the Nation's future needs came one step closer to realization in fiscal year 1959. In August 1958 a proposed amendment to the Helium Act of 1937, as

amended, was sent to Congress. The proposal reached Congress late in the second session to be considered; consequently, it has been re-submitted to the 86th Congress. If enacted, the legislation would make possible the conservation of helium now going to fuel such as a noncombustible component of some natural gases from the southwestern part of the United States.

To accomplish the conservation, up to 12 new helium plants are advocated. Private industry would be encouraged to finance, construct, and operate these plants under the proposed legislation. They would be located on interstate pipelines carrying natural gas with a helium content above 0.4 percent, to recover helium that otherwise would be lost to the atmosphere when the gas is burned for fuel.

These plants, in addition to four Bureau of Mines plants now operating and one now in construction near Keyes, Okla., could recover about 43.5 billion cubic feet of helium in the next 15 years. Total demand during that period is estimated at 11.5 billion cubic feet, leaving approximately 32 billion cubic feet for conservation in underground Federally owned storage.

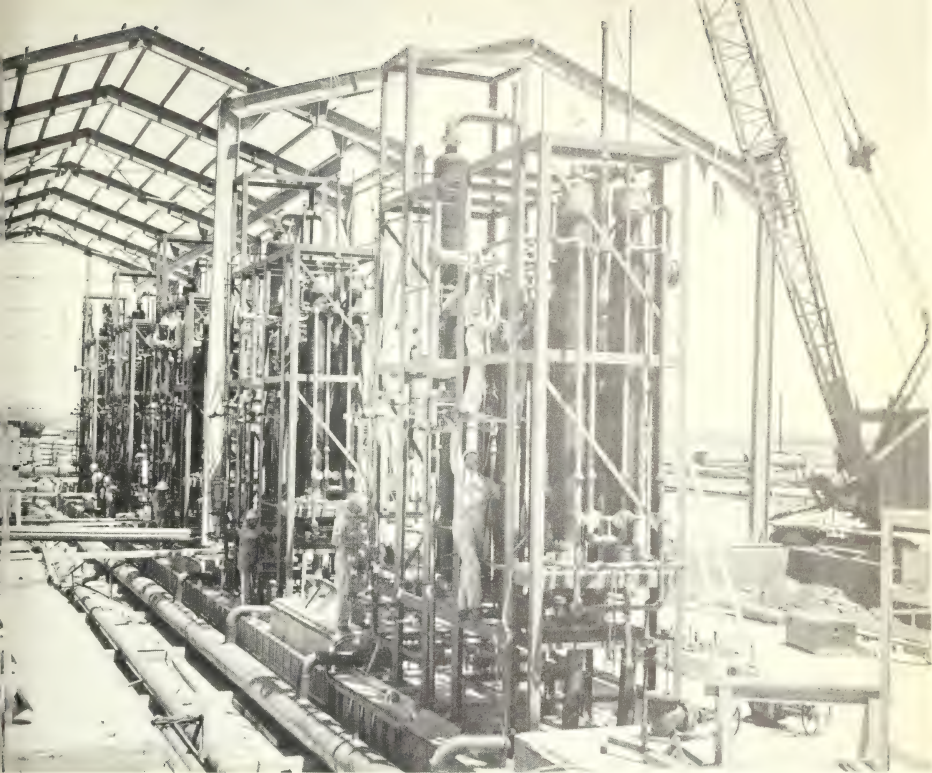
So that the current basic needs of the Federal agencies and commercial, medical, and scientific users can be met, Congress has made funds available to construct a new helium plant in the Keyes field of Cimarron County, Okla. Natural gas from this field contains about 2 percent helium, and the deposit is ample to supply the plant for many years.

Plant Nears Completion

The contract for engineering, design, and construction of the new plant was awarded to the Fluor Corp., Los Angeles, Calif., in November 1958. Good progress has been made in all phases of the work, and the plant will be in operation in August 1959. It is designed to produce 290 million cubic feet of helium a year.

The Bureau of Mines operated four helium plants in fiscal year 1959. The Amarillo and Exell, Tex., and Otis, Kans., plants were in production throughout the year. The Navajo plant at Shiprock, N. Mex., had to be shut down in August 1958 and put on a standby basis because of an insufficient supply of helium-bearing natural gas; however, the Pan American Petroleum Co., completed a new well in June 1959 about 8 miles from the Navajo plant. This well averages 5.8 percent helium. A gas-supply contract was negotiated with Pan American, and the plant is being reactivated.

Notwithstanding the loss of production from the Navajo plant, both production and shipments of helium reached new highs in fiscal year 1959. Output totaled 354 million cubic feet. In addition, 1,100



ing helium-purification units during construction of the new of Mines helium plant at Keyes, Okla. These five units, built Bureau's Amarillo, Tex., installation, have a combined capacity process more than $1\frac{1}{4}$ million cubic feet of helium a day.

of helium from underground storage in the Government-Cliffside gasfield near Amarillo, Tex., made possible shipments million cubic feet.

though production and shipments of helium were at record there was not enough to satisfy the needs of all users. With Federal agencies holding their requirements to a minimum, it possible, through an informal allocation system, to make helium ble for medical purposes, defense contract work, and most ic and research programs.

Uses of Helium

helium was used by the Air Force and Navy in rockets and es programs, by the National Aeronautics and Space Admin- an for wind-tunnel and shock-tube tests, by the Atomic Energy ssion in nuclear fuel reactor development, by the Weather to inflate meteorological balloons, by the National Instiute lth in medical research, and for many other purposes by

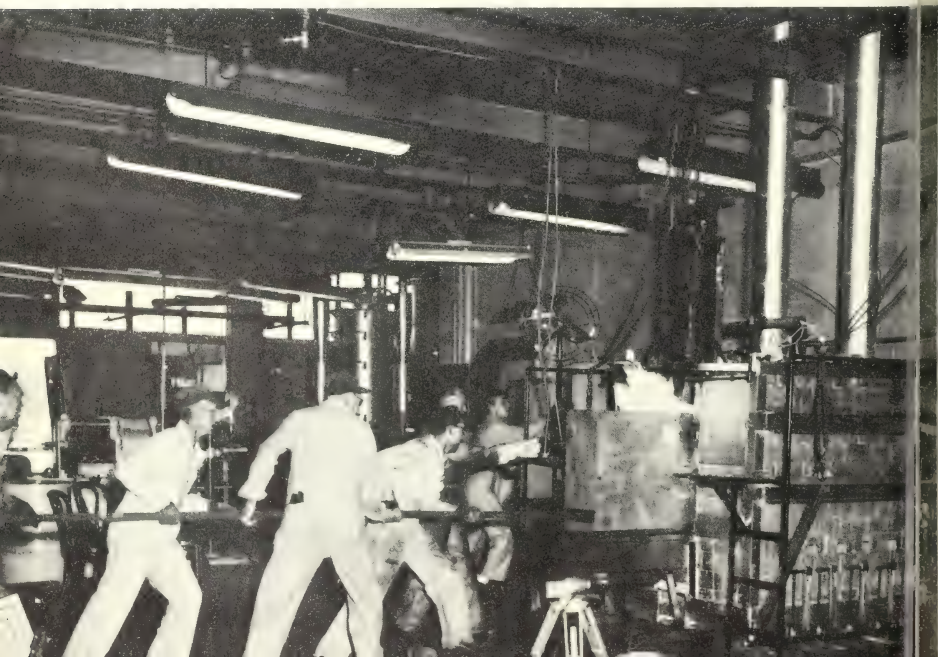
and other agencies. Commercial users employed helium in shielded arc welding, leak detection, gas chromatography, low-temperature research, inert atmospheres required in growing silicon and germanium crystals, and in medical and scientific research.

Nearly 80 percent of the helium shipped went to Federal agencies, and an estimated 75 percent of the helium delivered for commercial requirements was used on defense and atomic energy contract work.

Consequently, almost 95 percent of the helium shipped was utilized directly or indirectly to benefit the Federal Government. Most of the remaining 5 percent was used for medical purposes, by colleges and universities, and in private industry-supported research.

The Bureau's survey of new discoveries of natural gas in the United States was continued to determine sources of helium-bearing natural gas; however, no sources comparable to those already found were disclosed. The properties and characteristics of helium-bearing natural gas and helium-gas mixtures were studied to improve production, purification, and transportation methods and to reduce their cost. Much of this research will be useful in designing and building the helium plants proposed under the new conservation program. An open file of information developed from research relating to the extraction of helium from natural gas by low-temperature processes was made available in May to those interested in the conservation program.

A 500-pound mixture of coal is shoved into the Bureau's experimental coke oven in Denver, Colo., Coal-Research Laboratory.



Bituminous Coal Activities

Bituminous coal's share of the Nation's total energy market has declined steadily in recent years. To reverse this trend and to insure the continued availability of a resource that will become increasingly important as energy needs expand requires intensive research in all phases of coal operations, from extraction to utilization.

Technological Research

The Bureau's research on bituminous coal is oriented toward developing new or improved techniques to assure wise utilization. During fiscal year 1959, studies to evaluate the coal reserves of Alaska were continued by the Bureau and a preliminary reconnaissance was made of the Beluga River coal area.

In other realms of research, a field site was selected and high-pressure equipment was assembled for mining coal hydraulically. Plans were laid for studies of methods for degasifying coal beds—eliminating explosive methane—in advance of underground mining. A large percentage of the bituminous coal mined is processed to meet market requirements before shipping, and Bureau research is directed toward improving methods for cleaning coal, especially the fine sizes that usually are least responsive to mechanical treatment. Tests of the stationary-type DSM screen used in Europe demonstrated that it can size effectively very fine material with exceptionally high capacity. As a dewatering device, however, it is inferior to conventional vibrators. The efficiency and operating characteristics of mixers, i.e. the extent of mixing of certain types of solids as a function of number of revolutions and equipment design, also were studied. The cyclone washer, used widely in European coal preparation practice to treat a deslimed feed, is being tested to determine its efficiency in cleaning an unsized feed. Problems in lignite preparation and handling are also being studied. Research to develop means for overcoming the tendency of lignite to freeze during winter transit showed that the addition of air-dried lignite to the as-mined product is especially effective in preventing serious freezing.

Studies of the preparation and carbonizing characteristics of American coals continued; reports on coals from counties in Alabama, Kentucky, Pennsylvania, Virginia, and West Virginia, were published during the year.

New Irradiation Studies

Extending research on coal's structure and properties, the Bureau undertook new studies to determine the effects of irradiation on c l.

Examination of coal-analysis procedures also continued. A method for determining sulfur in coal ash was presented to ASTM for consideration as a standard, and two analytical techniques commonly used abroad were evaluated.

In research to improve combustion and furnace efficiency, the performance of large power boilers was investigated as a step toward more effective boiler design and operation.

Related studies sought ways of preventing corrosion in return-line condensates and deposition in boilers.

A large coal-fired gas turbine was loaned to the Bureau by the Locomotive Development Committee of Bituminous Coal Research, Inc. for tests through which the Bureau hopes to develop a coal-burning gas turbine capable of fulfilling the long-life requirements of stationary plants. The Bureau will work toward improved turbine blade design and improved materials of construction that will permit longer turbine blade life.

Research progressed on the use of ultrafine coal as a fuel for coal-burning gas turbines.

Studies continued on the mechanism and kinetics of coal carbonization, and coke-improvement studies were made of various coal blends. Attention was also directed toward differences in the properties of cokes prepared in experimental- and commercial-ovens in an attempt to explain and eliminate the factors responsible for these variations.

Knowledge gained in research on separating and characterizing low-temperature coal-tar products should provide a good basis for evaluating processes that will permit commercial upgrading and utilization of these tars.

Cooperation With AEC

Operating an electrically-heated simulated nuclear reactor, the Bureau continued to cooperate with the Atomic Energy Commission in studies to determine whether nuclear heat can make possible economic production from coal of synthesis gas—a source of high-B.t.u. gas or liquid fuels. Major emphasis is on developing suitable construction materials for the reactor and on determining mechanical and process components.

Gasification of lignite with steam and oxygen in a fixed-bed pilot plant, under slagging conditions, was investigated.

Experiments in gasifying coal underground indicated that gas obtained by this method cannot be produced and used economically in the United States under present technology.

In research on direct hydrogenation of coal, the Bureau investigated the possibility of simplifying this process and reducing its cost by reacting coal with sodium hydroxide. Hydrogenation of coal at high temperatures to produce methane also was investigated in a cooperative study, which indicated that 90 percent or more of the coal can be converted and the distribution of gaseous- and liquid-product products controlled within fairly wide limits.

Research on producing liquid fuels from coal by the Fischer-Tropsch process was continued, with emphasis on preparation and testing of catalysts and other studies directed toward improving the economics of the F-T synthesis.

Bituminous Coal Economics and Statistics

Although production of bituminous coal and lignite declined almost 4 percent during fiscal year 1959, there was a pronounced upturn in consumption during the last quarter, with major increases in coke ovens and electric-power utilities. While the upturn lagged behind that in the Nation's general economy, this was attributable largely to substantial drops in coal exports to Europe, resulting in increases in coal stocks abroad, import restrictions on United States coal, and increased competition from other energy sources. Besides publishing information on international coal trade, the Bureau assisted other Departments in connection with coal activities abroad, and prepared a report on the coal industry of the U.S.S.R. It also supplied detailed information for solid-fuels-mobilization planning, including data on coal-and coke-production capacities and regional availabilities of coal, coke and coal chemicals for strategic use.

Unprecedented interest by industry, business and Government in the new bituminous coal and lignite distribution reports resulted in a decision to continue this program for another year. The economic-research program in coal production, utilization, and exports is being expanded to provide a more accurate estimate of coal's position in the changing pattern of fuel-energy consumption.

Explosives and Explosions

Intensive research continued on the use of sodium chloride in mining explosives to reduce further their tendency to ignite flammable atmospheres. At the same time the ignition of fire-damp

by explosives was investigated, utilizing a statistical analysis of data from more than 3,000 experimental shots. Schedule tests of explosives, blasting devices, and similar equipment also continued.

In response to steadily growing industrial interest in fuel-sensitized, ammonium-nitrate blasting agents, the Bureau studied explosive sensitivity of these compositions, as well as problems associated with their use underground. Comprehensive tentative safety recommendations covering the preparation, storage, transportation, and use of these agents were provided to many users and others, with requests for comments.

Investigation of hazards associated with the large-scale production and handling of liquid hydrogen was undertaken for the Air Force, in addition to long-standing work on aircraft fuels and fluids. Work continued on reducing explosion hazards of combustible vapors in tanker holds. Flammability characteristics were determined for several industrial materials.

Experiments with hot gas jets issuing into combustible mixtures provided a better understanding of how gas is ignited by improperly used explosives and by flames flashing through narrow channels. In cooperation with the American Gas Association, progress was made in stabilizing flames of multiport burners and in a study of smoking flames. A new spherical vessel was developed to provide fundamental data on combustion reactions under high pressures. Photographic studies of turbulent flames continued.

In the Experimental Coal Mine, research on controlling mine fires with high expansion foams progressed; a technique employing a booster fan was developed. Investigations were completed on the hazard of fire-damp ignition by charges accidentally exposed (blown off) during multiple blasting and by frictional sparks in mines. Laboratory studies of factors affecting the explosibility of dusts and routine tests of various commercial dusts were continued.

Air Pollution

Continuing cooperative research on air pollution with the Public Health Service, the Bureau concluded a study of incineration and furthered projects on the composition and catalytic oxidation of automobile exhausts and on removing sulfur dioxide from steam-generating-station stack gases. Industry has shown great interest in the automobile exhaust and sulfur dioxide projects, which have been discussed at technical meetings, in the technical press, and in Bureau publications.

Anthracite Activities

During the year, the Bureau's anthracite program was directed toward finding more uses for this valuable fuel, developing improved anthracite-extraction techniques and carrying out the Federal government's responsibilities under the joint Federal-Commonwealth of Pennsylvania mine-water control program.

The Bureau is cooperating with a coal company in a mechanical-mining project designed to recover a 30-foot vein, pitching 25°, using a continuous borer with auxiliary loading and conveying equipment, a new-type auger for drilling crosscuts between gangways, and steel-arch roof supports. Output averages about 600 tons of run-of-mine coal a day; however, additional loaders and conveyors recently purchased should bring it to more than 1,200 tons a day. Production for fiscal year 1959 was estimated at 100,000 tons.

Phase I of a new slope-development project was completed, with 10 of eight planned gangways driven from the slope.

The Bureau continued its full-scale, longwall-mining project to develop a highly productive mining system for anthracite beds of moderate thickness and pitch. A longwall face was established, and a continuous mining machine imported from Germany was given limited tests. Major problems encountered were dust control and overhanging top coal. Equipment used on American continuous mining machines will be used to control dust, whereas water-jet methods are being studied for taking down top coal.

Research on the vertical hydraulic transportation of large-size solids in pipelines continued during the year, employing a 6-inch Plexiglass pipeline, 60 feet long, to determine specific gravity and settling velocities for various sizes and shapes of anthracite, slate, and rock. A variable-speed pump will be used to pump solids through this same line to observe their behavior at different speeds.

The pilot calciner was operated 6 months to produce calcined anthracite for foundry experiments. Tests in a merchant foundry indicated that fairly satisfactory melting could be obtained with calcined anthracite, but metal temperatures were not as high as those obtained with premium foundry coke. Though calcining seems to lessen thermal decrepitation the small size of the calcined fuel apparently limits its adaptability. The metallurgical-briquet pilot plant was completed and used to prepare nearly 100 tons of briquets for calcining. Equipment was designed and preparations made for studying the kinetics and thermodynamics of the anthracite-hydrogen reaction. Fundamental studies of the nitric-acid oxidation of

anthracite showed that at least seven reaction products are present in the acid-soluble portion.

Neutron-and gamma-radiation tests on samples of low-, medium- and high-volatile anthracite indicated that radiation increased the apparent hardness of each. Moreover, the number of free radicals increased markedly in the high- and medium-volatile samples. The effect of gamma radiation on the reactions of anthracite with selected chemicals will be investigated in the coming year.

Data obtained in studying the performance of small industrial stokers will be released in conjunction with a publication of the ASTM Code Tests.

Research on New Processes

Preparation research was concentrated on devising new processes and improving present ones for cleaning and sizing anthracite. The heavy-medium pilot plant was equipped with a radioactive detector to insure more precise control. A study of washability characteristics of Holmes and Mammoth seam anthracites was completed. Pulverizing tests showed that fine anthracite (100 percent minus 60 microns) can be prepared in an airswept ball mill.

Under the Federal-State Anthracite Mine-Water Control Program, eight projects were approved by the Secretary of the Interior during the fiscal year. The projects will cost an estimated \$4,400,000 of Federal and State funds.

Five projects costing \$2,107,000 were completed. At year's end four projects were under construction, and purchase contracts had been awarded on four others.

At the close of the year, 24 projects had been approved by the Secretary; 3 had been withdrawn because of changed conditions. The 21 remaining represent a total expenditure of \$7,700,000.

During the year, Bureau reports issued periodically on estimates of production, distribution, stocks, wholesale mine prices, hours and earnings, and other relevant data provided reliable information to the industry and the public.

River Basin Activities

Continuing to promote the conservation and development of water resources so essential to mineral production, the Bureau of Mines helped many Federal, State, and private agencies solve problems of water and power supply, mine drainage, pollution, and inundation of mineral resources.

Professional mineral-engineering consulting services were supplied to the Federal Power Commission, the U.S. Army Corps of Engineers, the Departments of Agriculture and Justice; and the Bureaus of Land Management and Reclamation and the National Park Service of the Department of the Interior regarding many mineral problems involved in water and land withdrawals. Where the Nation is faced with the loss of mineral deposits by inundation, ways were sought to preserve access to such deposits while permitting construction of water-development projects.

During the year, investigations and reviews of reports (other than special resource-consultation reports) included 64 for the Corps of Engineers, 31 for the Federal Power Commission, and 41 for the Department of Agriculture. Special detailed resource reports were prepared on 20 proposed Federal and non-Federal projects involving water, timber, and recreation. Nine others were in process at year's end.

The Bureau also supplied information to the Basin Study Commissions recently established for the Southeast and Texas.

Missouri Basin Project

Nine preliminary reports were completed for the Missouri Basin project, describing mineral resources and research related to water-power-development planning and progress was made on others. These included reports on mining and processing minerals for canal lining, coal, petroleum and natural gas, clay, and many other minerals.

Mineral-reconnaissance surveys were completed for the Department's Bureau of Reclamation on seven proposed reservoir sites.

Experiments on Dakota lignite showed that power requirements for pulverizing frozen lignite are significantly higher and the maximum feed rate attainable is lower than with unfrozen material—differences important to lignite-burning power stations. Experiments in the laboratory and at the Garrison Dam stockpile demonstrated the freezeproof character of partly dried lignite.

Cooperative research with the Bureau of Reclamation demonstrated that seepage is reduced significantly when certain sodium salts are added to the clay used for canal linings.

An inventory of water-borne mineral wastes is being made to pinpoint resources now lost which may be salvaged and utilized.

A sample survey of 52 mineral-industry plants in the Missouri basin showed their combined new water requirements to be 56,800,000 gallons per day compared to an average demand by Denver of 115,000,000 g.p.d.

The plants recirculate 210,500,000 g.p.d., consume 8,600,000 g.p. and return to the streams 48,200,000 g.p.d. The volume of circulated water indicates the importance of water and its conservation to the mineral industry.

Special Economic Studies

Economic conditions of the domestic metal-mining industries and the domestic petroleum industry were investigated during fiscal 1959, since many proposals to help the domestic mining industries were submitted to Congress and an import quota plan for lead and zinc was instituted by the President in October 1958.

The Bureau analyzed the effects upon supply, demand, employment, and price of each alternative and provided technical analysis to aid in establishing import quotas. Fiscal 1959 began with relatively depressed economic conditions, and ended with rapid recovery. The Bureau studied the effect on mining of these swings in economic activity, both nationally and on a local level.

A major study of supply, demand, and production capacity of crude oil, done at the request of the office of Civil and Defense Mobilization, developed historical relationships between price, production, gross national product in constant dollars, drilling activity, capacity, reserves, consumption of petroleum products, and other related variables. The historical patterns were used to project demand, production, and capacity to 1975 under alternative import assumptions, and a linear programming model of the "transportation" type was developed, analyzing the cost to the economy of interruption of particular supplies from overseas.

Studies were begun to gauge the effect of the European Common Market on mineral trade, specifically to prepare for large-scale multilateral tariff negotiations to be undertaken under the renewed Trade Agreements authority. Analysis of the complex trade-and-tariff structure involves detailed examination of trade patterns, supply and demand, import restrictions of all types, and possible institutional changes, such as international commodity agreements.

Public Reports

Manuscripts describing Bureau research and other findings totaled approximately 650 during the Fiscal Year, about the same as in the previous year. A significant accomplishment was the publication of 7 Minerals Yearbook volumes in a single year, thus erasing

that had developed because of the press of other work in World War II. Among the other publications issued were 157 separate reprint chapters of the Yearbook, 83 reports of investigations, 68 information circulars, and 29 miscellaneous reports. Bureau authors prepared 264 articles for journals and technical meetings. The circulation of the Bureau's industry-sponsored 16 mm. sound motion pictures continued at a high level. Showings totaled 228,348 group audiences of 12,658,584. Cooperating distributing centers—school systems, public libraries, and colleges stood at 187. Approximately 5,800 prints were in circulation. Among the new film subjects added during the year were "Rubber on Oil," and "Asbestos—A Matter of Time." Three new films were in production at year's end.

Administration

During fiscal year 1959, the Bureau continued to emphasize efficient administration of its varied scientific and technical programs. Significant improvements are summarized in the following sections:

Organization and Management

Several organizational changes were made in the Bureau's five regions and in its Health and Safety Activities to promote more effective utilization of scientific personnel. Wherever possible, research workers were relieved of administrative responsibilities and encouraged to direct their energies into the areas of science in which they are most proficient.

Accomplishments at Bureau field installations and at Washington headquarters showed a mounting interest in the Department of the Interior's management improvement program. Studies to improve organization, communications, and technical-report writing predominated. Three Bureau-wide management-improvement projects were begun in January 1959 to: (1) Identify and resolve problems in publishing results of technologic investigations and resource and economic studies; (2) improve monthly reports to the Director and the Secretary, and (3) study retirement attrition and forecast its influence on organization and training of Bureau of Mines personnel. Two regions issued regulations and instructions supplemental to, and in the format of, the Bureau of Mines Manual. Using the Manual's numerical designations to classify such material helped maintain regional instructions with related Bureau-wide and Department-wide instructions. Regions III and IV serial administrative orders have been discontinued.

Property

The Bureau's use and disposal of excess and surplus personal property is shown in the following table:

| Fiscal year | Obtained from other Government agencies | Fair value of property obtained | Disposal value |
|-------------|---|---------------------------------|----------------|
| 1959..... | \$476,474 | \$5,840 | \$21,725 |
| 1958..... | 612,970 | 7,016 | 21,400 |
| 1957..... | 88,970 | 2,498 | 31,500 |
| 1956..... | 190,451 | 3,210 | 7,000 |
| 1955..... | 57,597 | 3,350 | 31,410 |

¹ Personal property disposed of through donation, abandonment, sale, and transfer to other Government agencies.

Emphasis was placed on the Records-Management Program during the year, and 23 employees attended records-management conferences throughout the country. Records holdings were reduced 12.9 cubic feet during the fiscal year.

Finance

The Bureau continued its orderly improvement of accounting functions relating to coordinating financial management to serve the needs of technical programs during the year. By revising manual material and by periodic visits to field offices, accounting activities are being integrated with the technical policies and practices of the Bureau.

The Bureau of Mines accounted for funds totaling \$67,849,545, which includes direct appropriations, prior-year balances available, reimbursements, advances and transfers from other Government agencies, and proceeds from non-Government sources. Of this amount, \$51,490,499 was obligated, leaving an unobligated balance of \$16,359,046.

Funds available and obligations incurred, by source, fiscal year 1959

| | Funds available | Obligations incurred |
|--|-----------------|----------------------|
| Conservation and development of mineral resources..... | \$21,508,978 | \$21,520 |
| Health and safety..... | 6,371,283 | 6,260 |
| Construction..... | 13,900,702 | 12,240 |
| General administrative expenses..... | 1,195,029 | 1,090 |
| Anthracite mine drainage..... | 6,819,059 | 900 |
| Consolidated working funds..... | 2,893,768 | 2,630 |
| Transfer appropriation accounts..... | 1,274,725 | 1,180 |
| Contributions from non-Government sources..... | 1,213,563 | 1,070 |
| Helium operations..... | 12,672,438 | 14,640 |
| Total..... | 67,849,545 | 51,490,499 |

¹ Accrued expenditures.

Training

An employee was appointed to provide technical direction to bureauwide training activities. Three employees participated in the Departmental Management-Training Program; one participated in the Departmental Manager-Development Program. Special training agreements with the U.S. Civil Service regional officer provided for training four Health and Safety employees in administrative procedures. The Bureau's Advisory Committee on Training and Development of Employees was increasingly active in matters concerning general training policy and implementation of the Government Employees Training Act. A Training Actions Subcommittee was formed in Washington, D.C., to consider requests for training employees at non-Federal facilities. Regional and activity committees were established to advise Bureau officials on training needs and desirable training activities, and to screen applicants for training.

Labor Relations

More staff assistance was provided on labor relations, particularly the Helium Activity. This included assistance on a union decertification hearing and interpreting and applying recently issued departmental labor-relations policies and instructions.

Staffing

A Bureau-wide Merit-Promotion Plan covering positions in grades GS-13 and above and local merit-promotion plans for positions in grades GS-12 and below were developed and placed in operation. These plans involved extensive consultation with employees and employee groups, including employee unions.

A Coal-Mine-Inspector register, created under new examining techniques, was established during the year. The new methods included a written examination, personal interview, and evaluation of experience based on identification and evaluation of the job elements that comprise a coal-mine inspector position (J-Coefficient technique). A new Safety-Representative examination has been developed and evaluated, involving techniques similar to those of the Coal-Mine-Inspector examination.

Employee Safety

The Bureau won the Department's Annual Safety Award for its safety program and outstanding safety record in calendar year 1958. A Radiation Safety Training Seminar was held at its Pittsburgh station during the fall.

Classification and Wages

In addition to usual activities to assure compliance to classification requirements, Bureau personnel made field trips, reviewed wage schedules and amendments, submitted comments on tentative classification standards, and provided administrative training in classification and wages.

Civil Service Examining Board

During the year, 93 certificates and 1 Civil Service Commission Form 303 were issued. A summary of the Washington Board activities for fiscal year 1959 follows:

| | |
|----------------------------------|---|
| Active registers..... | 1 |
| Examinations announced..... | 6 |
| Applications received..... | 7 |
| Applications rated..... | 9 |
| Applications rated eligible..... | |
| Placements..... | |

Schedule and number of paid employees

| | GS | | Ungraded | | Total | |
|-------------------|-------|-------|----------|------|-------|-------|
| | 1958 | 1959 | 1958 | 1959 | 1958 | 1959 |
| Departmental..... | 646 | 652 | | | 646 | 652 |
| Field..... | 2,920 | 2,932 | 904 | 894 | 3,824 | 3,826 |
| Total..... | 3,566 | 3,584 | 904 | 894 | 4,470 | 4,420 |

Incentive Awards

A comparative tabulation of incentive awards in the past 5 years reveals some changes of emphasis in the program. For example, greater attention is now given to Superior Performance Awards and Special Service Awards.

| | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 |
|--|----------|----------|----------|----------|-------------|-------------|
| Suggestions received..... | 245 | 497 | 971 | 752 | 788 | 2,250 |
| Suggestions adopted..... | 66 | 157 | 320 | 263 | 299 | 1,010 |
| Cash awards granted for adopted suggestions..... | \$1,160 | \$5,040 | \$8,520 | \$6,750 | \$7,485 | \$9,950 |
| Superior performance awards granted..... | 2 | 44 | 57 | 76 | 105 | 280 |
| Cash awards presented for superior performance..... | \$400 | \$9,015 | \$16,464 | \$18,200 | \$28,300 | \$37,870 |
| Special service awards granted..... | | 2 | 3 | 5 | 4 | 1 |
| Cash awards granted for special service awards..... | | \$400 | \$1,300 | \$2,250 | \$1,200 | \$1,190 |
| Total estimated annual savings realized from adopted suggestions and superior performance..... | \$72,297 | \$32,297 | \$63,484 | \$44,995 | \$1,026,000 | \$1,026,000 |
| Honorary awards granted..... | 38 | 45 | 38 | 52 | 72 | 24 |
| Length-of-service awards granted..... | | | | 2,190 | 239 | 429 |

Office of Oil and Gas

Capt. Matthew V. Carson, Jr. (USN), *Director*



THE OFFICE OF OIL AND GAS is the staff agency of the Department which assists and advises the Secretary of the Interior and the Assistant Secretary for Mineral Resources in the discharge of their responsibilities concerned with the development, coordination, and management of petroleum and gas programs assigned to the Department by the President and Congress.

In addition to its domestic activities, it has important international duties, particularly in support of NATO planning and in providing petroleum guidance in connection with development of U.S. foreign policy. The Office of Oil and Gas is the focal point for coordination and leadership in governmental oil and gas activities. By keeping abreast of oil production, refining, transportation, storage, gas transmission and distribution in the United States and the rest of the world, it is in a position to provide detailed guidance on problems and policies having an impact on petroleum and gas supply.

The Office of Oil and Gas maintains direct channels of communication with the petroleum and gas industry through the National Petroleum Council, Military Petroleum Advisory Board, and the Foreign Petroleum Supply Committee, all of whose members are appointed by the Secretary of the Interior.

The director of the Office of Oil and Gas maintains close liaison with the State regulatory agencies in the petroleum and gas producing states, and with the Interstate Oil Compact Commission through participation at its meetings in his official capacity as the Department's representative to IOCC. At a public hearing in May 1959, the Director presented to the Congress a departmental report recommending favorable action on extension of the interstate compact to conserve oil and gas for another 4 years from September 1, 1959.

This year the Office of Oil and Gas furnished technical advice and assistance directly to many Federal agencies, and maintained repre-

servation on interagency committees. Staff members served on the State Department Committee which provided backstop support for the U.S. Delegation to the NATO Petroleum Planning Committee and on State's special committees which collaborated with other Government agencies in dealing with foreign oil problems involving world petroleum supply and demand. Office officials also participated in the defense mobilization committee activities of OCDM, particularly those concerned with national security policy involving petroleum and gas. Staff support was given to departmental operations through the development of specific information and the preparation of reports, as well as representation on departmental task groups that deal with legislative matters, Executive Reserve, coordination of defense and mobilization activities, and administrative management.

Highlights of the fiscal year 1959 include:

Plans for Petroleum and Gas in an Emergency

Preemergency readiness measures are being developed to assure insofar as possible, adequate supplies of petroleum and gas in a national emergency. This year the Office completed a detailed statement of the emergency responsibilities of Federal, State, and local governments, as well as industry itself, for maximizing the production, transportation, processing, storage and distribution of petroleum and gas. Measures by which these responsibilities would be carried out in a period of international tension, limited war, or general emergency are delineated. The guidance will be published in annex 33 to the OCDM National Plan for Civil Defense and Defense Mobilization.

To carry out these emergency responsibilities, The Office of Petroleum and Gas has developed a plan for operational direction and coordination of the petroleum and gas industries. It provides for the establishment of a national agency and field offices in the eight OCS regions and in each State to carry out the functions outlined in the foregoing annex. The National Petroleum Council is reviewing the plan and assisting the office to recruit staff for the emergency organizations by furnishing names of qualified oil and gas specialists who would be subject to call if needed as members of the National Defense Executive Reserve of the Department of the Interior.

Civil Defense Exercises

Nationwide exercises are held annually to examine the readiness of the Nation to meet a nuclear attack on the United States and to

test our capabilities to withstand and survive such an attack. The Office of Oil and Gas has the responsibility for pre-planning to cope with the problems of oil and gas supply and distribution. The Office participated in all phases of the Operation Alert exercises conducted in 1958 and 1959, and was also involved in the independent exercise conducted to test Federal communications facilities. In addition, personnel served with the departmental cadre which manned the Relocation Center during the year.

Detection and Measurement of Radioactivity

During the year, a team of departmental employees, including an official of the Office, developed and conducted a course in radiological monitoring of fallout caused by atomic explosions. The course is being given to petroleum and gas, coal and electric power industry groups, and to Government officials. This 34-hour course provides training on the use of instruments to detect and measure radioactivity. Two staff members and six members of the oil and gas industry have taken the course. Radiological monitoring of fallout being highly important to the continuity of petroleum and gas industry operations, arrangements will be made to extend the training to a large number of industry personnel next year.

Emergency Port Facility Study

An elaborate emergency tanker loading and unloading study providing detailed data regarding facility capability was completed for the Department of Defense. Work on this project took up much of the time of one member of the staff for some months as it was necessary to visit all U.S. coastal areas in order to study the facilities and to obtain firsthand information from management personnel.

Long-Range Petroleum Study

The background studies of U.S. supply capabilities and requirements of petroleum upon which to base a long range national security policy were approaching the final stages of preparation within the Department as the fiscal year ended. The Office is coordinating departmental activities in connection with this study requested by COM, and both the Department's Geological Survey and its Bureau of Mines are participating in the work.

NATO Petroleum Planning Committee

Technical advice and assistance was given to the NATO Petroleum Planning Committee during the fiscal year. As a member of the United States delegation, the Director attended committee meetings held in Paris, France, during January. An Assistant Director of the Office served as chairman of the Working Group which developed and carried on oil supply-demand and related studies that are essential in NATO defense planning and the preservation of petroleum security. This Working Group held meetings in Paris during October 1958 and April 1959.

Foreign Petroleum Supply Committee

Authority exists for taking action under the Voluntary Agreement Relating to Foreign Petroleum Supply as amended May 8, 1958, should an emergency arise outside the United States which would threaten to affect or adversely affect the defense mobilization interests or programs of the United States. As established, pursuant to section 708 of the Defense Production Act of 1950 as amended, the Secretary of the Interior Fred A. Seaton, or the Assistant Secretary of the Interior for Mineral Resources Royce A. Hardy, serve as Administrators of the agreement.

To assist in accomplishing the objectives of the agreement is the Foreign Petroleum Supply Committee composed of senior officials of 16 American oil companies engaged in foreign petroleum operations. The Director of the Office of Oil and Gas is its Chairman.

FPSC performs two principal functions: (a) When requested by the Department, it provides advice on how the Government may obtain needed information relating to foreign petroleum operations and to requirements and supplies of petroleum. (b) It may conduct studies and make recommendations designed to prevent, eliminate, or alleviate shortages of petroleum supplies in friendly foreign nations threatening to, or adversely affecting, the defense mobilization interests or programs of the United States.

Secretary of the Interior Fred A. Seaton called the FPSC into session on July 23, 1958, to explore the oil supply conditions in the light of threatening conditions in the Middle East. The Government of Iraq had fallen. American troops were stationed in Lebanon and British troops in Jordan at the request of the respective governments of these countries. The members of the Committee were asked to comment on a plan of action worked out by several Government agencies in order that action might be taken quickly should the need arise. Subsequent developments in the Middle East rendered unnecessary putting the proposed plan in effect.

National Petroleum Council

Amendments to the National Petroleum Council's articles of organization were worked out during the year to satisfy the procedural requirements established by the Attorney General for functioning of industry advisory groups. The modifications contain provisions for appointment of fulltime officials of the Department of the Interior as Co-Chairman of the Council and its study committees, for procedures in the appointment of members of the Council's committees and subcommittees, for the call and conduct of meetings, formulation of agenda, and the preparation and custody of minutes.

NPC met once during the fiscal year. At the meeting held January 7, 1959, the Council adopted the amendments and agreed to undertake assignments to comply with three requests for reports and information needed by Government. Study committees have been organized and the work was in progress when the fiscal year ended.

Incentive of Accelerated Tax Amortization

As accelerated tax amortization under the Internal Revenue Code for oil and gas projects has expired, activities were limited to the preparation of twenty reports and recommendations to OCDM on requests for post certification actions on certificates of necessity issued prior by OCDM.

Office of Minerals Exploration

Frank E. Johnson, *Acting Director*



THE OFFICE OF MINERALS EXPLORATION of the Department of the Interior was established by the Secretary of the Interior on September 11, 1958, to conduct a program of Federal financial assistance in exploration for mineral reserves, excluding organic fuels, in the United States, its Territories and possessions pursuant to Public Law 85-701 enacted August 21, 1958.

The OME is also administering contracts in force and certain projects remaining from the exploration program conducted from mid-1951 to June 30, 1958, by the Department's former Defense Minerals Exploration Administration, under the Defense Production Act of 1950, as amended. The DMEA contracts in force prior to June 30, 1958, have been continued in accordance with the contract provisions until terminated. The amount of the Government's financial commitment in any of these contracts, however, has not been increased where the results have progressed to a point at which certification of discovery or development could be issued.

The New OME Program

The proposed regulations for the new OME program were published in the Federal Register on September 17, 1958. Interested parties were given 30 days to submit written comments, suggestions or objections concerning them to the Director of OME. On December 23, 1959, the regulations under which OME operates were published in the Federal Register.

New forms, procedures, and instructions regarding the OME program were devised and issued. The new application forms were made available to the public in January 1959, and more than 200

requests for these forms were filled before the end of the fiscal year. The first OME application was received in February and the first contract was executed in May 1959.

Administration of OME

Under the OME program, the Government participates to the extent of not more than 50 percent of the allowable costs in exploration for minerals, excluding organic fuels, but the amount of the Government's contribution is limited to \$250,000 on any one contract. The following mineral commodities are eligible for Federal financial assistance: Antimony, asbestos (strategic), bauxite, beryl, columbium, chromite, cobalt, columbium, copper, corundum, diamond (industrial), fluor spar, graphite (crucible flake), kyanite (strategic), lead, manganese, mercury, mica (strategic), molybdenum, monazite, nickel, platinum group metals, quartz crystal (piezoelectric), rare earths, rutile-brookite, selenium, talc (block steatite), tantalum, thorium, tin, uranium, and zinc.

After careful investigation, based upon sound geological and engineering principles, the Government enters into a contract with an operator to explore for one or more of these mineral commodities. In passing upon applications for Federal financial assistance the following factors are considered and weighed:

- (a) The geological probability of a significant discovery being made.
- (b) The estimated cost of the exploration in relation to the size and grade of the potential deposit.
- (c) The plan and method of conducting the exploration.
- (d) The accessibility of the project area.
- (e) The background and operating experience of the applicant.
- (f) The applicant's title or right to possession of the property.
- (g) The unavailability of funds from commercial sources on reasonable terms.
- (h) Whether the applicant would normally undertake the exploration at his sole expense under current conditions or circumstances.

Provisions of Contract

The exploration work in which the Government will share in the cost is set forth in the contract with the operator who performs the work. The contract specifies the land involved, the work to be done, the allowable costs, the dates for starting and completing the work, the total amount of the contract, and the amount of the Gov-

ernment's participation. It contains the standard provisions of Government contracts relating to nondiscrimination, settlement of disputes, 8-hour law, and rebate of wages.

The contract also provides for repayment of the Government's contribution with interest by a royalty on production from the property subject to the contract. If there is no production, there is no obligation to repay. Royalty payments of five percent of the gross proceeds or value are required on any production from the date of the contract until the Government notifies the operator, not later than 6 months after an acceptable final report and an accounting have been furnished, either that it certifies that mineral or nonmineral production may be possible as a result of the exploration or that it does not intend to issue such certification.

If the Government issues a certification, the operator, or his successor in interest, is required to continue to pay the royalty on all production from the property until the Government's contribution with interest is fully repaid or until the period fixed in the contract for royalty payments (usually 10 years but not more than 25 years) has elapsed, whichever occurs first.

Payment of Interest

Simple interest is calculated from the date Federal funds are made available to the operator until the period specified for royalty payments expires or until the amount of Federal funds contributed, including interest, is fully repaid by the royalty on production, whichever occurs first. The rate of interest is not less than the rate which the Department of the Interior would be required to pay if it borrowed from the Treasury, plus a 2 percent interest charge in lieu of the actual cost to the Government of administering the contract.

The OME employs a small staff in the Washington Office and two field auditors to administer the OME program and liquidate the DMEA program. Administrative services available from the Office of the Secretary and the Solicitor's staff of the Department of the Interior are utilized in the program. The staffs of the Bureau of Mines and the Geological Survey—both agencies of the Department—are used to administer the program in the field.

During the period of this report the OME reduced its staff from 33 to 22 employees because of budgetary limitations and anticipated reduction in workload. This reduction was accomplished by cancelling vacancies caused by retirements and transfers, so that 14 of the four reduction-in-force notices were given to employees to effect the reduction. The Bureau of Mines and Geological Survey effected

comparable reductions in the numbers of employees assigned to OME work during this period.

In order to effect more efficient operations and reduce administrative costs, three of the OME Commodity Divisions were abolished and the Region IV field office is being abolished and its work transferred to Regions III and V. So as to consolidate the work, the Region II office at Reno, Nev. is being transferred to San Francisco, Calif. and the region III office at Denver, Colo. is being transferred to the nearby Federal Center.

Summary of OME Operations

OME operations for the fiscal year 1959 are summarized under headings below:

Applications

During the fiscal year, 57 applications were received from 19 States requesting financial assistance in exploration for 19 different mineral commodities. Actions taken on these applications are shown in the following tabulation:

OME Application Summary

| Action | Number |
|------------------------------------|--------|
| Received..... | 57 |
| Reviewed..... | 12 |
| Drawn..... | 7 |
| Completed as of June 30, 1959..... | 30 |
| Contracts executed..... | 8 |

Contracts

The OME executed 8 contracts in 7 States covering 5 mineral commodities as shown in the table below:

OME contract summary

| State | Commodity | Amount of contract | Amount of Government participation |
|---------------------|-----------------------|--------------------|------------------------------------|
| Idaho..... | Lead-Zinc-Copper..... | \$43,550 | \$21,775 |
| Montana..... | Lead-Zinc..... | 13,900 | 6,950 |
| New Hampshire..... | Mica..... | 9,850 | 4,925 |
| North Carolina..... | Mica..... | 8,464 | 4,232 |
| Oregon..... | Mercury..... | 47,910 | 23,955 |
| Utah..... | Lead-Zinc..... | 43,926 | 21,963 |
| Virginia..... | Lead-Zinc-Copper..... | 12,990 | 6,495 |

Summary of DMEA Operations

The DMEA operations for fiscal year 1959, and for the entire program are summarized under the headings below:

Applications

Applications under the DMEA program were not accepted after June 30, 1958; however, 65 DMEA applications received prior to that date were in various stages of processing on termination of the program. The applicants were informed their DMEA applications would be processed under the OME program upon written request. Fifteen of these 65 DMEA applicants have reappplied under the OME program, 7 have stated their intentions to reapply under the OME program, 12 have indicated they were no longer interested in proceeding with their applications, and 31 have only replied to the letters sent to them in regard to their applications.

Contracts

On June 30, 1958, 170 DMEA contracts remained in force. This number was reduced to 50 by the end of this fiscal year. The table below summarizes DMEA contract data for fiscal year 1959 and the entire program:

DMEA contract summary

| Contracts | Fiscal 1959 | | | Program through June 30, 1959 | | | |
|---|-------------|-------------|--------------------------|-------------------------------|-----------------------|--------------------------|---------------------------------------|
| | Number | Costs | Government participation | Number | Total estimated costs | Government participation | Government participation on contracts |
| Contracts as originally executed..... | | | | 1, 159 | \$50, 547, 489 | \$31, 056, 412 | |
| Amendments which changed contract amounts..... | 3 | \$4, 071 | \$2, 056 | 218 | 6, 244, 262 | 3, 761, 478 | |
| Contracts plus amendments (net)..... | | | | | 56, 802, 182 | 34, 823, 125 | \$22, 978, 60 |
| Projects certified as discoveries..... | 37 | 3, 632, 310 | 2, 333, 535 | 1, 374 | 25, 443, 931 | 16, 023, 763 | 12, 578, 78 |
| Projects terminated without certification..... | 64 | 4, 350, 832 | 2, 639, 896 | 661 | 21, 835, 812 | 13, 576, 132 | 7, 256, 26 |
| Contracts canceled without Government expenditure..... | 9 | 213, 931 | 122, 539 | 80 | 2, 133, 553 | 1, 304, 390 | |
| Contracts in force as of June 30, 1959 not certified..... | | | | 44 | 7, 388, 886 | 3, 918, 840 | 1, 559, 59 |

¹ Includes 6 projects in force. Also included are figures relating to 2 projects which were certified canceled, i.e., no Government funds were spent.

ifications

During the fiscal year 1959, 37 Certifications of Discovery or Development were issued on DMEA projects. The total of such certified projects is now 374. (See table I.)

DMEA Ore Potential and Royalties

The recoverable mineral commodities found on the 374 certified DMEA projects are estimated to have a gross value of \$625,000,000 based upon market prices in effect at the close of the fiscal year. Substantial additions to this estimate are anticipated from the 44 certified DMEA contracts remaining in force on June 30, 1959. Royalties collected incident to the sale of materials found under DMEA contracts continued at a relatively high rate during fiscal 1959. A total of \$620,834 has been received during this year, and \$1,127,068 since the start of the program. Forty-three projects have paid in full the amounts contributed by the Government to them, namely \$1,268,217.

DMEA royalty summary

| Type of project paying | Program through June 30, 1959 | |
|--|-------------------------------|-----------------|
| | Number | Amount received |
| Found as a discovery or development..... | 272 | \$2, 860, 253 |
| Discovery agreement (qualified certifications)..... | 20 | 76, 532 |
| Certified (obligation to pay derives from contract)..... | 107 | 190, 283 |
| Total..... | 399 | 3, 127, 068 |

DMEA Audits

At the end of the fiscal year, approximately 93 percent of the DMEA contract disbursements had been audited. The details of the audit program are shown in the following table:

DMEA audit summary

| Audits | Fiscal 1959 | Program through June 30, 1959 |
|---|---------------|-------------------------------|
| Overall audits: | | |
| Number made..... | 110 | 1, 227 |
| Number of projects audited..... | 97 | 1, 038 |
| Costs claimed by operator..... | \$4, 908, 576 | \$34, 944, 708 |
| Amount of participation certified by audit..... | \$2, 875, 763 | \$21, 040, 959 |
| Partial audits: | | |
| Number made..... | 145 | 434 |
| Number of projects audited..... | 100 | 312 |
| Amount of production subject to audit..... | \$8, 221, 772 | \$36, 256, 807 |
| Amount of royalty payable..... | \$402, 435 | \$1, 771, 024 |

DMEA projects certified—Distribution by State and commodity (as of June 30, 1959)

| | Antimony | Asbestos | Beryl-Mica | Chromium | Cobalt-Nickel | Columbium-Tantalum | Copper | Corundum | Fluorspar | Iron | Lead-Zinc | Lead-Zinc-Copper | Manganese | Mercury | Mica | Monazite | Rutile | Sulphur | Talc | Thorium | Tin | Tungsten | Uranium | Total |
|----------------|----------|----------|------------|----------|---------------|--------------------|--------|----------|-----------|------|-----------|------------------|-----------|---------|------|----------|--------|---------|------|---------|-----|----------|---------|-------|
| Alabama | | | | | | | | | | 1 | | | | | 2 | | | | | | 2 | | | 3 |
| Alaska | 2 | | | | | | | | | | | | | | | | | | | | | | | 6 |
| Arizona | | 4 | | | | | 5 | | | | 3 | 2 | | | | | | | | | | 1 | | 18 |
| Arkansas | | | | | | | | | | | | | 2 | | | | | | | | | 3 | | 2 |
| California | | | | | | | | | | | | | 1 | | | | | | | | | 8 | 1 | 23 |
| Colorado | | | 2 | 1 | | | 1 | | 1 | 1 | 10 | 3 | 1 | 6 | | | | | | 3 | | 11 | 26 | 55 |
| Florida | | | | | | | | | | | | | | | | | 1 | | | | | | | 1 |
| Georgia | | | 1 | | | | 1 | | | | 14 | 3 | 1 | | 4 | | | | | | | 4 | | 6 |
| Idaho | 1 | | | | 3 | 1 | 1 | | 3 | | | | | | 1 | 3 | | | | | | | | 31 |
| Illinois | | | | | | | | | | | 1 | | | | | | | | | | | | | 3 |
| Iowa | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| Maine | | | 1 | | | | | | | | | | | | | | | | | | | | | 1 |
| Michigan | | | | | | | 2 | | | | | | | | | | | | | | | | | 2 |
| Missouri | | | | | 1 | | | | | | 2 | | | | | | | | | | | | | 3 |
| Montana | | | | | | | 1 | | | | | 1 | 5 | | 1 | | | | | | | 6 | 1 | 19 |
| Nevada | | | | | | | 1 | | 1 | | 3 | | 1 | 2 | | | | | | | | 14 | | 23 |
| New Hampshire | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| New Jersey | | | | | | | 2 | | | 1 | 2 | | | | | | | | | | | | | 1 |
| New Mexico | | | | | | | | | | | | | 2 | | | | | | 1 | | | | 5 | 11 |
| North Carolina | | | | | | | | | | | 2 | | | 2 | 58 | | | | | | | 1 | | 61 |
| Oregon | | | | | | 1 | | | | | | | | | | | | | | | | | | 2 |
| South Carolina | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| South Dakota | | | 5 | | | | | | | | 1 | | | | 1 | | | | | | 1 | | | 9 |
| Tennessee | | | | | | | | | | | 2 | | | | | | | | | | | | | 2 |
| Texas | | | | | | | | | | | | 1 | | 1 | | | | | | | | 4 | 30 | 47 |
| Utah | | | | | | | | | 1 | | 10 | | | | | | | | | | | | | 1 |
| Vermont | | 1 | | | | | 1 | | | | | | | | | | | | | | | | | 2 |
| Virginia | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| Washington | | | | | | | | | | | 6 | | | | | | 1 | | | | | 1 | | 12 |
| Wisconsin | 1 | | | | | | | | | | 10 | | | | | | | | | | | | | 10 |
| Wyoming | | | | | | | | | | | | | | | | | | 1 | | | | | 13 | 14 |
| Total | 4 | 5 | 9 | 1 | 4 | 2 | 17 | 1 | 6 | 3 | 69 | 14 | 13 | 13 | 68 | 4 | 2 | 1 | 1 | 3 | 3 | 53 | 78 | 374 |

Office of Minerals Mobilization

Spencer S. Shannon, *Director*



OFFICE OF MINERALS MOBILIZATION carries out the assignment of the Interior's responsibility for national defense readiness in metals, minerals and solid fuels, and for civil deprocurement, transportation and distribution of solid fuels, in accordance with basic policies and programs approved by the Office of Civil and Defense Mobilization.

During the past year, the Office maintained constant surveillance of the ability of the Nation to meet estimated national defense emergency requirements for the 85 strategic minerals, metals, and solid fuels from domestic wartime production, from wartime imports, and from the Government stockpiles. In cooperation with the Bureau of Mines and the Geological Survey of the Department, the Office evaluated changes in markets, prices, production, reserves, and productive capacity to insure that the Nation would maintain an adequate domestic production component of the mobilization program for strategic metals, minerals and solid fuels. Special attention was given to those strategic metals and minerals which are experiencing market difficulties.

During fiscal year 1959 comprehensive mobilization evaluations were completed on beryl, fluorspar, columbium-tantalum, tungsten. A review was made of the July 1958 fluorspar study. Supply studies were also made on asbestos and copper.

For revised evaluations were made on high temperature and refractory property materials. The original study on this subject was made in December 1957 at the request of the Chairman of the National Special Stockpile Advisory Committee. Since that time, the Office has followed closely the rapidly changing development in the field of materials and has prepared revised reports on a semi-annual basis.

Reports were also made on the effect of imports on the national security on cobalt, fluorspar and tungsten in connection with section 8 of the Trade Agreements Act.

The Office advised and assisted the Office of Civil and Defense Mobilization in carrying out the stockpiling programs. Problems relating to disposal of Government inventories of metals and minerals in excess of national defense requirements required increased attention during fiscal year 1959.

The Director served as the Department's representative on the Interagency Materials Advisory Committee and on the Supplemental Stockpile Advisory Committee for Barter on acquisition by barter of materials for the Supplemental Stockpile in exchange for surplus agricultural commodities.

During the year 14 additional industrialists were appointed to the OMM unit of the National Defense Executive Reserve to be available to serve in the event of a national emergency. In April and again in May, various members of the Reserve were brought to Headquarters for training.

The Office assembled and transmitted to emergency relocation essential documents to permit continuity of government in case of an emergency. It prepared input data for use in the National Damage Assessment Center computing machines on theoretical damage to metals, minerals and coke producing facilities.

At the end of fiscal year 1959, State Agreements had been initiated with 27 States and the District of Columbia on OCDM programs for emergency distribution of solid fuels.

Office of Geography

Meredith F. Burrill, *Director*



THE DEPARTMENT'S OFFICE OF GEOGRAPHY provided staff service for the Board on Geographic Names and the Secretary of the Interior, except that after October 1, 1958, staff service relating to domestic names was provided by the Geological Survey. Statistical information on production is included in the report of the Board. The gazetteers referred to represent thorough revision and severalfold enlargement of previous files of official standardized names for those areas.

In the revision process many kinds of toponymic problems were brought into focus and increasing attention was devoted to the coordinated joint geographic-linguistic research that is necessary to solve them. A beginning was made in the formulation and statement of toponymic principles and theory that may bring significant advances in the quality and usability of the standardized names.

Board on Geographic Names

Walter W. Ristow, *Chairman*

Meredith F. Burrill, *Executive Secretary*

THE INTERDEPARTMENTAL BOARD on Geographic Names was established under Public Law 242, July 25, 1947, entitled "An Act to provide a central authority for standardizing geographic names for the purpose of eliminating duplication in standardizing such names among the Federal departments, and for other purposes."

The Board is composed of representatives of the Departments of Interior, State, Army, Navy, Post Office, Agriculture, Commerce and Air Force; the Government Printing Office, the Library of Congress and the Central Intelligence Agency.

The Board establishes policies under which geographic names are standardized, approves transliteration and transcription systems as may be necessary for the romanization of names, and approves individual names for use in Federal publications.

The Department of the Interior maintains the standard name files and other records of the Board and provides staff assistance to the Board. Under Departmental Order No. 2829, dated July 10, 1948, the records, name files, and staff functions relating to domestic geographic names were transferred from the Office of Geography to the Geological Survey. Records and functions relating to foreign names were continued in the Office of Geography.

In 1959, the Board approved for publication in gazetteers more than 450,000 names, including about 300,000 standard names and 150,000 variant names, covering principally the U.S.S.R. and certain neighboring areas, the Baltic States, Bulgaria, the Soviet Union of Germany, and Egypt. Nomenclature policies were reviewed and revised as necessary for the above areas and numerous other foreign areas as required by the various agencies. Editing of names on maps and in texts was performed on a moderate scale and more than 16,000 name inquiries were answered by telephone and mail.

Transliteration systems for Burmese, Cambodian, and Amharic are under study with a view toward possible adoption jointly with English-speaking nations. The Board's advisory committees on Antarctic Names and on Arabic and Persian were active in their work of special interest.

Some 1,200 proposed domestic name decisions were issued on check lists, some 600 names were approved, and a decision list containing 879 names was published.

Office of the Assistant Secretary *Public Land Management*

Ernst, *Assistant Secretary*



THE ASSISTANT SECRETARY for Public Land Management, discharging the Secretary's duties in that field, directs and supervises the Bureau of Land Management, the National Park Service, the Bureau of Indian Affairs, and the Office of Territories.

The last-named agency celebrated with Hawaii as that territory attained Statehood to climax its 50-year campaign for full membership in the Republic. Alaska had achieved congressional approval on the last day of fiscal 1958, but was not formally admitted until January 3, 1959. Hawaiians endorsed their new status at the polls by the thunderous majority of 17 to 1. Hawaii formally became a State shortly after the close of the fiscal year, on August 21, 1959. In other areas administered by the Office of Territories, American Samoa reeled under the blows of a typhoon, while the Trust Territory of the Pacific Islands was still fighting its way back to economic recovery from the damage caused by the previous year's typhoons. Despite storm damage, Samoa's economic gains were gratifying. The same was true of Guam.

The Virgin Islands forged ahead in tourism and other fields. The Territory's total revenues reached a record high. The Government-owned Virgin Islands Corporation received authorization to build a new water distillation plant which will also produce electrical power. The Alaska Railroad, also Government-owned, and paying the highest railroad wages of any line in the world, showed a net profit of more than \$200,000 above the previous year.

The Bureau of Indian Affairs continued its emphasis on educating Indian children to equip them for a richer life. School enrollment reached the all-time high of 132,000, with 61 percent of the young-

sters in public schools where they have the advantage of studying with non-Indians. Construction projects were speeded and provide more than 1,000 additional classroom seats in fiscal 1959.

Tribal leaders and private Indian interest groups hailed Secretary Seaton's statement at Window Rock, Ariz., on September 18, 1958, which reviewed the stated intentions of Congress to remove Indian tribes from Federal supervision, at the earliest possible time, or practicable date, and declaring what the Congress expressed in its resolution of 1953 "was to state an objective, not an immediate goal."

Adult education programs were continued at 80 different locations on reservations and in Alaska's native villages. Cooperation arrangements were worked out to provide adoptive homes for Indian waifs.

On the Klamath Reservation in Oregon plans advanced for permitting the withdrawing members to manage their own agricultural Forest lands and other properties belonging to the nonwithdrawing members were transferred to a private trustee for management. The Menominees of Wisconsin were given conditional acceptance of their multiphased plan for taking over their property and administration.

Two new industrial plants were established near reservations in Oregon and North Carolina, offering additional job opportunities.

Oil and gas lease income paid more than \$46.5 million to tribal and individual Indian landowners during the year. Timber production brought in about \$10 million more.

The Bureau of Land Management, landlord of the public domain, had gross receipts totaling nearly \$137 million from its sale and management of the public lands and resources during the year. The money was distributed to the General Fund of the United States Treasury, to 27 public land States, the Reclamation Fund, Indian Trust funds, other Government agencies and to grazing districts to be used for improving the range. Fiscal 1959 receipts pushed the Bureau's total receipts to more than \$1.2 billion since the Bureau was organized in 1946.

The Bureau adopted "protracted surveys"—lines drawn on maps where boundaries have not been laid out on the ground—an improved system will help Alaska select the more than 103 million acres granted in its Statehood Act.

Cracking down on violators of oil and gas lease acreage limitations, the Department initiated three contest proceedings against individuals charged with obtaining acreage holdings in excess of the limitations of the Mineral Leasing Act.

As in past years, fires wrought terrific damage on public lands. But new and better protective systems kept the loss from increasing.

worse. The Bureau has given a high priority to its smoke-per operation in Alaska, where airborne firefighters in parachutes needed to combat fast-breaking flames in roadless areas hundreds of miles from settlements.

With oil and gas leasing of the public lands at the highest point in history, the lands yielded more than 132 million barrels of petroleum. Almost 2 billion board feet of timber from public lands brought more than \$32 million. During the year, 33,000 acres were reforested. Public lands provided grazing for more than 10 million head of cattle, sheep and horses, and wildlife. Leasing of the submerged lands on the Outer Continental Shelf, suspended during fiscal 1958, was resumed in fiscal 1959.

The Department, through the National Park Service, expended and obligated more than \$95 million for 1,418 projects, during the fiscal year of its Mission 66 development program. Thirteen new visitor centers were completed. Twenty others were under construction. The road program provided for 117 miles of new or reconstructed routes.

Land and Portage National Monument and General Grant National Memorial were authorized, and a Secretarial order established the Minute Man Historical Site in Massachusetts.

The rate of park visits made it evident that the 80 million visits projected for 1966, the 50th anniversary of the founding of the Service, was too conservative an estimate. The original Mission 66 plan is being restudied. Campers by the thousands showed that camping is growing in popularity among Americans.

But there are also many millions who want to sleep and eat in comfort in the parks. Private enterprise spent some \$4.5 million to improve concessioner facilities for visitors. Sixteen new concession contracts were authorized during the year.

Anger III, a new 96-passenger motor craft, entered service during the year to furnish adequate access to Isle Royale National

Many new interpretative markers were installed along the sides of park roads and trails, informing the motorist or hiker of the significance of the areas. Archeological research went forward in a number of areas.

Almost 79,000 acres of inholdings were acquired. The Department submitted legislation, now pending in Congress, which would authorize the Secretary to select three shoreline areas for inclusion in the National Park System.



Bureau of Indian Affairs

Glenn L. Emmons, *Commissioner*



ONE OF THE MOST IMPORTANT DEVELOPMENTS of the year in Federal administration of Indian affairs was Secretary of the Interior Seaton's radio address of September 18, 1958, from Flagstaff, Ariz., clarifying the Department's position on the centrally important question of terminating Federal trust responsibilities for Indian tribal groups.

Referring to the resolution on this subject adopted by Congress in 1953 (H. Con. Res. No. 108 of the 83rd Cong.), Secretary Seaton called attention to the varying interpretations given to this document over the preceding 5 years and specifically mentioned the impression created by some interpreters that "it is the intention of Congress and the Department of the Interior to abandon Indian tribes regardless of their ability to fend for themselves."

In his talk, Secretary Seaton strongly repudiated any such interpretation. "To me," he said, "it would be incredible, even criminal, to send any Indian tribe out into the mainstream of American life and unless the educational level of that tribe was one which was equal to the responsibilities which it was shouldering."

At another point, he summarized his position succinctly in the following words: . . . no Indian tribe or group should end its relationship with the Federal Government unless such tribe or group has fully demonstrated—first, that it understands the plan under which such a program would go forward, and second, that the tribe or group affected concurs in and supports the plan proposed."

Following the delivery of this talk, expressions of approval and support of the Department's position were received from many Indian leaders as well as from numerous private organizations active in the field of Indian affairs.

The one piece of new Indian terminal legislation enacted by Congress during fiscal 1959 was in full harmony with the Department's

position. It covers 41 small Indian groups in California which explicitly asked for such legislation and provides for a referendum on each property distribution or termination plan before it becomes effective. By the end of the period 23 of the groups had submitted such plans and these had been tentatively approved by the Department. No referendum, however, had yet been held.

Klamath Amendment Enacted

Another development of salient importance in the field of termination legislation was the Congressional enactment of a major amendment of the 1954 terminal law affecting the Klamath Tribes in Oregon. The amendment was concerned with sale of the tribal property to compensate the withdrawing members. In brief, it provided for (1) joint action by the Secretaries of the Interior and Agriculture in designating the Klamath tribal forest lands requiring continuous sustained-yield management, (2) offering of these lands to private purchasers subject to sustained-yield-management requirements, (3) Federal purchase of the Klamath marshlands as a national wildlife refuge, and (4) Federal purchase of the unsold forest units for addition to the national forest system. The maximum price to be paid for forest and marshlands together was set at \$90,000,000.

Following the enactment of this amendment in August 1958, action was taken to reappraise the tribal properties and to designate the sustained-yield-management forest units. Of the 11 units designated, four were offered for sale in April 1959, and the others will be offered in fiscal 1960. An area of about 145,000 acres was set aside for the remaining tribal members and was transferred to a private trustee in March 1959.

Apart from termination activity, the Department's Bureau of Indian Affairs made steady and substantial progress during 1959 in providing Indian people with better and broader educational and economic opportunities.

Enrollment of Indian children of school age in schools of all types increased by about 2 percent to an alltime-high figure of approximately 132,000. In schools operated by the Bureau, significant advances were made in adjusting the instructional programs to meet the needs of Indian pupils now arriving at school age. Adult education classes were continued on the reservations and were carried forward at 80 locations as compared with 75 in 1958. Grants were made available by the Bureau to help over 500 Indian students in obtaining an education beyond the high-school level.

Adult vocational training was made available during the year for

17 individual Indians as compared with 376 in fiscal 1958, which was the first year of operation for the program. In the field of industrial development, contacts were established by Bureau field personnel with over 400 concerns and new plants were started near the Matilla Reservation in Oregon and the Cherokee Reservation in North Carolina.

Record Royalty Income

Income to Indian tribes and individuals from leasing of their lands for oil and gas development declined for the second year in a row to a record-smashing total of nearly \$72,000,000 which was achieved in 1957. In 1959 the income from this source totaled \$46,745,874. This was the third highest figure ever recorded. Although there was a substantial decrease in bonus income during 1959, the increasing production on Indian (especially Navajo) lands was reflected in an alltime-high royalty income figure of \$30,172,382. This compared with \$18,453,532 in 1958.

Sales of timber from Indian lands advanced during the fiscal year and cash receipts from this source totaled about \$10,000,000 as compared with approximately \$8,250,000 the preceding year.

Education

Enrollment of Indian children of school age increased approximately 2 percent in fiscal 1959 as compared to the preceding year. Of the 132,000 enrolled, 61 percent attended public schools, 30 percent were in Federal schools, and 9 percent in mission and other private schools. Public school enrollment increased by approximately 2,300 students.

Although Indian children are entitled to free education in the public schools of the States where they reside, the Bureau of Indian Affairs for many years has been providing aid for public schools to relieve substantial numbers of Indian children residing on tax-exempt lands. These funds have been made available to help the children in meeting undue financial burdens resulting from the enrollment of such Indian children and have been furnished under the acts negotiated with State and local school agencies in accordance with the provisions of the Johnson-O'Malley Act of 1934.

In fiscal 1959, a new Federal aid resource was made available to the school districts educating eligible Indian children when Congress, by the act of August 13, 1958, amended Public Law 874, 81st Con-

gress (64 Stat. 1100). Under this amendment the Department of Health, Education, and Welfare was authorized to count Indian children from tax-exempt land in providing assistance to meet part of the costs of normal school operations. In school districts qualifying for assistance for Indian children under Public Law 874, as amended, supplemental aid provided by the Bureau of Indian Affairs under the Johnson-O'Malley Act is limited to meeting educational problems under extraordinary circumstances including special services to help Indians that may best be made under education contract.

As a result, the Bureau spent considerable time in 1959 reviewing plans and operations to coordinate the programs and avoid duplication of aid. Because approximately one-half of the 1,026 local school districts participating under the Johnson-O'Malley program qualify for some Public Law 874 aid, the total expenditures for Indian Bureau education contracts covering Indian children attending public schools were reduced in 1959 to \$5,201,000 as compared to \$8,300,000 that would have been needed had the new Public Law 874 resource not been available. The need for 1960 is estimated at \$5,000,000.

285 Schools Operated

The Bureau of Indian Affairs in fiscal 1959 operated 285 schools with an enrollment of 41,182 including those under 6 and over 18 years of age. In addition, dormitory facilities were provided at 11 locations for 3,169 students who attended public schools. Part of the Indian school, a reservation boarding school in Anadarko Area, five trailer schools and Towaoc Dormitory in the Gallup Area, and five instructional aid schools in Alaska were closed in 1959. Two of the instructional aid schools and one trailer school were operated as regular day schools with fully qualified teachers. Most of the students in the closed schools, excepting those in the three instructional aid schools, were transferred to public schools, although a few requiring boarding school care were placed in other boarding schools.

The Fort Defiance Boarding School, one of the oldest in the Bureau, established about 1880, was closed in March 1959 because of fire safety hazards in the dormitories. Immediate temporary arrangements were made to reassign students to other schools in order that they should not lose the important last few weeks of the school year.

Plans were also made during the fiscal year to expand the Bureau's school facilities at other locations. At Albuquerque, N. Mex., construction was started on two new dormitories to house 512 students.

and to be opened at the beginning of the 1959 fall term. At four localities in Alaska construction was activated on six additional classrooms to provide space for an additional 180 pupils by the same deadline. And at Fort Wingate, N. Mex., a major construction project was launched to increase the school's capacity by about 325 students. This latter project was scheduled for completion some time after the start of the new school term.

Adjustment in Instructional Programs

As compared to earlier years, the present-day Indian students are more similar to their public school contemporaries in sophistication, age-grade placement, academic achievement, desire to complete high school, and financial resources for obtaining higher education. The table below indicates the average age of high school students in one particular Federal school in 1936, 1958, and in 1959.

Average age by grade

| Year | IX | X | XI | XII |
|------|------|------|------|------|
| 1936 | 20.4 | 19.1 | 20.0 | 19.8 |
| 1958 | 15.4 | 16.3 | 17.1 | 18.4 |
| 1959 | 15.2 | 16.2 | 17.3 | 18.1 |

To meet the needs of these young people, the Bureau successfully developed with school administrators and, to some extent, with parents and parents the concept "high school is not enough" if Indians are to compete with other citizens in professional, technological, and vocational fields.

Definite steps taken in 1959 to meet the special needs of Indians in Federal schools included: (1) balancing the school curricula to provide a solid academic program for those going on to college and a high-school program with 2 years of exploratory vocational courses for those who want advanced training in technical or vocational fields; (2) emphasizing language skills and improving reading programs at all grade levels and in the content courses; and (3) strengthening the dormitory programs by closely coordinating them with other school programs to make the dormitories major laboratories for educational, social and cultural growth.

Reservation Adult Education Program

Reservation adult education units served 80 communities under the jurisdiction of 24 agencies or area field offices in 1959. The program

was continued at approximately the 1958 level although there were many requests for additional projects. The appropriation for reservation adult education projects was \$200,000 in 1958 and 1959. In 1960, the amount is doubled which will permit considerable expansion of the program.

The objective of these programs is to raise the general educational level of adult Indians particularly in the subject matter where they feel a need for more training. Reading, writing, oral English, and basic arithmetic are given careful attention in the groups with previous schooling. Intermediate school subjects and special courses are given those with at least 5 years of schooling. Certificates equivalent to high school diplomas are awarded. In groups with relatively high educational attainment and interest in civic affairs, community problems are studied with a view to promoting an awareness of civic responsibility. These discussions include community sanitation, recreation, juvenile delinquency, and participation in civic functions.

Scholarship Program

More than 500 Indian students were assisted in obtaining advanced education beyond the high-school level in fiscal year 1959 by Federal grant funds in the amount of \$145,000 as compared to 484 students in 1958 who received approximately \$132,000. The appropriation for 1960 is \$250,000 which will assist capable young people who would otherwise forego advanced education. The Shoshone Tribe of Wyoming established a scholarship grant program in 1958. The Arapaho Tribe of Wyoming established a similar program in 1959. Some 25 tribes provide funds for scholarships for their members. In 1959, approximately \$500,000 was designated for this purpose.

Welfare

There was an overall increase in Indian welfare needs during 1959, both for financial assistance to needy persons and for other social services. The Bureau of Indian Affairs continued its emphasis, within the limits of available resources, on providing services to assist Indians in dealing with their personal problems and managing their own affairs as well as on providing financial assistance to the needy. Child welfare services were made available for dependent, neglected, and handicapped children when such services were not available through other public agencies.



adult education class in the 49th State—at Kwigillingok, Alaska.

General Assistance

The need for general assistance increased considerably during the year. This is attributed in large part to a continuing decline in employment opportunities for unskilled labor and to increased living costs which resulted in higher assistance grants. The number of Indians who received general assistance was approximately 20 percent higher in fiscal 1959 than in fiscal 1958, and the expenditure for such assistance was approximately 23 percent higher. The increase occurred chiefly in the Aberdeen and Muskogee Areas and the Cherokee Reservation in North Carolina (where there was no assistance program for only part of fiscal year 1958). It was necessary also to supplement the tribal assistance program on the Lake Reservation in Minnesota with Federal funds during fiscal 1959 because of exhaustion of the tribal welfare funds.

In several other areas there was comparatively little change, and in two areas there was a decrease in both caseload and assistance expenditures. The number of Indians receiving general assistance in fiscal 1959 ranged in the usual seasonal pattern from a low of 283 households comprising 6,185 persons in September 1958 to

a high of 5,052 comprising 16,752 persons in February 1959. The average monthly grant per household was \$68.05 (\$22.91 per person).

Child Welfare

During the year the Bureau completed contract arrangements with the Child Welfare League of America for a 3-year pilot project on a small scale to facilitate the finding of good adoptive homes for homeless Indian infants. This project was developed because of the unmet needs of infants and unmarried mothers reported from reservations and a lack of sufficient adoptive homes in many of the States with a large Indian population.

Under the pilot project, Bureau social workers on selected reservations can refer homeless infants for adoptive placement to qualified adoptive agencies selected by the Child Welfare League. The major purposes of the project are (1) to demonstrate that adoptive homes can be found for homeless Indian children as an alternative to foster care, and so assist unmarried mothers, who heretofore had little choice in deciding what plan was best for their children; and (2) to stimulate the interest of public and private agencies in the problems of Indian children.

The Child Welfare League selected two highly qualified adoptive agencies in New York and Delaware to participate in the project, and several children have already been accepted by these agencies. A desirable byproduct is that, as a result of the project activities, the attention of some State welfare agencies has been focused more than heretofore upon adoptive placements for Indian children.

The long-standing problem of jurisdiction—resulting from the position taken by certain State courts that where State law and order does not extend to a reservation, the State has no legal jurisdiction over Indian children living on the reservation—continues to hinder or prevent the provision of appropriate protective services for dependent, neglected, or delinquent Indian children on such reservations. Cases involving adoption, custody and commitment to appropriate specialized State institutions are affected.

There are, however, some prospects of progress in this confused legal situation. The State Department of Public Welfare in the State is seeking a ruling from the State Supreme Court regarding State court jurisdiction over Indian children. In another State, Bureau and State officials cooperatively have prepared material for a legal test of the jurisdiction of the State's juvenile court over Indian children on a reservation. The Bureau's Branch of Welfare, acting through the Interdepartmental Committee on Children and Youth, has requested consideration of jurisdictional questions affect-

Indian children in the 1960 White House Conference on Children and Youth. The 1960 White House Conference staff has suggested consideration of this problem, among others, to its State committees.

Law and Order

During the fiscal year 1959 no new legislation was enacted by the State pursuant to Public Law 280, 83d Congress, to assume civil and criminal jurisdiction over Indian land in such State. The constitutionality of legislation enacted in 1957 by the State of Washington pursuant to Public Law 280, was challenged in a case that arose on the Tulalip Reservation involving an offense committed by a Tulalip Indian.

The challenge was made on the ground that the State statute violated article 26 of the State constitution because, it was contended, the State constitution had to be amended before the legislature could act pursuant to Public Law 280. The Washington State Supreme Court, recognizing the emergency situation which the over court ruling created in law enforcement on ten reservations in the State, granted a writ of certiorari, and in a decision handed down on March 26, 1959, in a case entitled *State of Washington v. ...*, held that the 1957 statute was not unconstitutional.

At the close of the 1958 fiscal year, there was pending before the United States Supreme Court on a writ of certiorari the case entitled *Williams v. Lee* which involved the question of the application of State civil process against an Indian on the Navajo Reservation. The Supreme Court of Arizona had ruled that such process was applicable. The United States Supreme Court, in deciding the Lee Case (358 U.S. 217) during this fiscal year, held that the Arizona courts are not free to exercise jurisdiction over a civil suit by one who is not an Indian against an Indian where the cause of action arose on the reservation. The effects of the Lee decision are not yet known.

By the act of August 8, 1958 (Public Law 85-615; 72 Stat. 545), Public Law 280 was amended to add Alaska to the list of States that have civil and criminal jurisdiction over the Indian country in those States. On the basis of the 1958 statute, the Bureau terminated law enforcement activities in Alaska as of June 30, 1959.

During the year a rather important interpretation was made with respect to the assumption of jurisdiction by States under Public Law 280. The view was expressed, with the concurrence of the Director of the Department, that a reasonable interpretation of

the statute, in light of its clear purpose to give the States complete control over the timing of the State action, would permit a State to proceed on a "piecemeal" basis in the assumption of jurisdiction. This could be done either geographically or in terms of subject matter (i.e. by the State assuming jurisdiction in certain types of cases). Some tribal attorneys and some Bureau of Indian Affairs field personnel seem to feel that "piecemeal" assumption of jurisdiction on a subject matter basis will enable progress to be made in the transfer of jurisdiction although the Solicitor pointed out that this could lead to complexities and difficulties.

Arts and Crafts

The Indian Arts and Crafts Board continues to encourage production and sales organizations owned and operated by Indians.

An excellent example of what can be accomplished through such organizations is provided by the Qualla Arts and Crafts Mutual, Inc., Cherokee, N. C., from the time it was organized in December 1946 to December 31, 1958.

From early times the Cherokee Indians have been noted for their fine basketry, excellent wood products made from the hardwoods of their mountains, and articles woven from wool as well as from corn shucks and cane cuttings. Dolls were among their products as well as a variety of beadwork.

The teachers in the Cherokee schools encouraged this work. Emphasis was placed on high standards of craftsmanship and encouragement was given in the use of their traditional designs. Further interest was stimulated when large numbers of tourists began visiting the Great Smoky Mountains. The public was interested in not only seeing but buying these beautiful and useful handicrafts.

Traders in the village of Cherokee, quick to see good business in Indian crafts, began to buy and offer them for resale to the tourist trade. Unfortunately, this trader market gave the craftsmen little opportunity to set their own prices for their products. The common practice was for the Indian craftsman to offer his wares to the trader who in turn would quote his giving price on an established "take it or leave it" basis.

Cherokee craftsmen organize

Encouraged by the Cherokee Indian Agency officials and assisted by the Indian Arts and Crafts Board, the Cherokee craftsmen

formally organized in December 1946 so that through coordinated efforts they might better their production, establish fairer prices and find a wider market for their products. The organization is now self-sufficient. It has its own officers, its board of directors, its committees on standards, membership qualifications, and sales. It has no outstanding debts and sales are growing. Of most importance is the prospect this coming year for the completion of a new \$50,000 sales center building on the highway. The proof of this successful venture may be found in the answer to these questions: Of what value is the co-op on the reservation? Who gets the money?



A Cherokee father-daughter team demonstrate the making of beautiful and useful salad bowls at their Craftsman's Fair.

| | |
|---|-----------|
| 1. Crafts bought from producing members over the last 13 years amounted to ----- | \$241,624 |
| 2. Dividends paid to producing members on the basis of their sales to the co-op over the 13 years ----- | 8,353 |
| 3. Salaries paid to its employees by the co-op since the highway shop was put into operation 10 years ago ----- | 26,701 |
| 4. Rent paid to the Tribal Council for sales-room space for 10 years ----- | 10,861 |
| 5. Reservation levy or business tax paid to the Tribal Council over the past 7 years ----- | 5,378 |
| 6. Equity paid in full to membership for 1946 ----- | 1,123 |
| 7. Equity paid in full for deceased members ----- | 1,121 |
| Total cash paid by co-op to individual Cherokee craftsmen and to Tribal Council ----- | 295,466 |
| Present equity or value that the active members now have in their organization is ----- | 41,596 |

There are 202 members (eight deceased) in the organization. A few members are not presently active producers. Six members have full-time jobs as craftsmen. The others use crafts as a supplementary income and many members depend almost entirely on the sale of their crafts for the family food during the fall and winter months.

The sale of Cherokee crafts through the cooperative has shown a steady gain, starting in 1946 with \$7,000 and increasing to \$38,890 in 1958. The total sales for the 13-year period amounted to \$350,260.78.

Tribal Programs

The act of August 18, 1958 (72 Stat. 619), known as the California Rancheria Act, provides for distribution of the land and assets of 41 of the 116 Indian rancherias and reservations in California. Approximately 1,387 people are in position to benefit by the distribution of 7,617 acres of land at these 41 locations.

Residents of these rancherias by resolution requested this legislation. In most cases they also requested that certain actions be taken by the Federal Government before title to the lands passed to them. The legislation provides that a plan shall be prepared for each rancheria by the Indians outlining how and to whom the assets shall be distributed. Such a plan, when approved by the Secretary of The Interior and accepted by the participants, becomes the operating program under which title is transferred from the Federal Government to the Indians.

Under the law the Department of the Interior, thru its Bureau of Indian Affairs, is required to (1) assist the Indians in the preparation of the plan, (2) help in the organization of legal entities if the Indians decide to hold property in common, (3) have ex-

rior and interior surveys made of the rancheria lands, (4) complete road construction or improvements, (5) install and rehabilitate water systems, (6) cancel reimbursable indebtedness against the lands, (7) arrange land exchanges, (8) convey Federally owned property, (9) distribute funds held in trust, (10) protect the rights of minors or persons non compos mentis, (11) undertake a special educational training program for the Indians involved, and (12) execute conveyancing instruments. When the plans have been completed, approved, and accepted, the Indians participating will no longer be entitled, as Indians, to special Federal services.

Authority to administer the act was delegated to the Commissioner of Indian Affairs and in turn to the Area Director at Sacramento. The Secretary of the Interior retained authority to review appeals where there were any objections to a plan filed, and to publish regulations and proclamations in the Federal Register. The Commissioner retained authority to approve the plans, cancel reimbursable indebtednesses and to revoke constitutions and charters. Regulations were published on June 9, 1959, as section 242.1 through section 242.10 of chapter I, sub-chapter V—Termination of Federal Indian Relationships, of the Code of Federal Regulations.

In the first year of the law's operation 23 of the 41 rancherias submitted plans which were tentatively approved. Each plan is posted on the lands of the rancheria for 30 days during which time objections may be filed. If no objections are received, the plan is given final approval and, when accepted by a referendum vote of the participants, is carried out. If objections are received, the Secretary of the Interior may revise the plan before giving final approval. Plans for the other 18 rancherias are expected to be completed during fiscal 1960, and the provisions of all the plans carried out on or before the end of the calendar year 1962.

Klamath Indians of Oregon

In January 1958, the Secretary of the Interior by executive communication asked the Congress to protect the conservation management of the Klamath Indian forest, which was subject to disposal pursuant to the act of August 13, 1954 (68 Stat. 718), as amended, terminating Federal trusteeship of the Tribe. The Congress immediately took this under consideration and further amended the Klamath Act by passing the act of August 23, 1958 (72 Stat. 816).

Primarily this amendment required that the 1957 appraisal of the tribal assets be reviewed and that boundaries be established for the forest lands requiring sustained-yield management. The amendment also provided that the designated forest lands would first be

offered to private purchasers subject to a covenant for sustained yield management. If not so purchased, they would be acquired by the United States Government (subject to an overall maximum of \$90,000,000) and added to the national forest system. In addition, title to the marsh lands would be taken in the name of the United States Government and designated as the Klamath Forest National Wildlife Refuge. Lands lying outside the forest and marsh boundaries (fringe units), selected to be sold for the benefit of withdrawing members, would be sold without the sustained-yield covenant.

The 1958 amendment also postponed the date for completing termination procedures for an additional year to August 13, 1960.

Practically all of the so-called fringe units have now been sold, mostly to tribal members. Four sustained-yield units were advertised for sale on April 20, 1959, with opening of the bids scheduled for January 20, 1960. Three more units were advertised July 1, 1959, and the remaining four units will be advertised November 1, 1959.

Special Loan Program Arranged

Because of the delay in the sales of the properties, extended by the last amendment, a special loan program was arranged for the Klamaths. By the act of June 11, 1959 (73 Stat. 70), legislative authority was obtained to make loans without interest to Klamath withdrawing members regardless of their degree of Indian blood.

On March 3, 1959, the trust for the management of the remaining group's properties was executed. Forest and other lands totaling 144,485.55 acres and funds in excess of \$749,000.00 were transferred to the United States National Bank of Portland, the designated trustee.

The act of August 23, 1958, ended the services of the Management Specialists, and their functions were assumed by the Bureau of Indian Affairs. In compliance with section 15 of the basic act, as amended, requiring protective measures for minors and others in need of assistance in conducting their affairs, over 200 guardianships and conservatorships and 911 trusts were established.

Menominee

The act of June 17, 1954 (68 Stat. 250), as amended, required that the Menominee Tribe of Wisconsin prepare and submit to the Secretary of the Interior by February 1, 1959, a plan for taking over its property and affairs in an unrestricted status. The Secretary is directed to accept the plan as a basis for lifting the special

federal trusteeship and conveying the property if he finds that it meets the tribal membership with reasonable equity and conforms to applicable Federal and State law. The plan can be implemented any time up to, but not later than, December 31, 1960, when the Secretary of the Interior must have proclaimed the termination of the Federal trusteeship.

On January 26, 1959, the Menominee Tribe conditionally submitted a plan comprising articles of incorporation and bylaws for the organization of its commercial property, a voting trust for the supervision of its corporation, an income bond indenture, a bulk trust proposal for the administration of the interests of minors and incompetents; and a many-faceted package of proposed legislation that was concurrently submitted to the Wisconsin State Legislature to provide for the creation of a new Menominee County embracing the reservation area, a merger of the existing 10 townships into 1 township contiguous with the proposed county, a special system of taxation and sustained-yield timber management regulation by the State, a merger of school districts and court jurisdictions with neighboring counties, and numerous other detailed provisions.

The Department of the Interior responded to the Tribe's proposal on April 30, 1959, after affording the Tribe all the time permissible under the statute to remove its conditions and make the plan available for action in an approvable form. It was pointed out that approval was made difficult by the proviso that "the Tribe's approval of such plan is conditioned on acceptance by the Wisconsin Legislature of the legislative proposals substantially as submitted," that conformity to State law was contingent on proposed statutes not yet enacted (yet which would be integral components for the plan's functioning), and that a vital part (the corporation's bond indenture) was provided for but not then drafted.

The Department held that the plan was not approvable *per se*, but accepted it as structurally feasible and approvable in principle once contingencies were removed. The Tribe's plan was then adopted conditionally by the Secretary of the Interior as his plan for the approvable statutory period of 3 months in order to work out its contingencies. By the close of the fiscal year the Tribe's proposal had undergone extensive compromising and adjustment before the State Legislative Council and the Legislature, and August 1 became the deadline by which the plan would have to be refined to the mutual satisfaction of the Tribe and the Secretary.¹

After this reporting period the Governor of Wisconsin did sign the Menominee proposal into law but it was on July 30, only 2 days before the August 1 deadline. The Secretary of the Interior responded on July 31, that he was approving the Tribe's plan "in principle" but that a period after August 1 would have to be allowed by the Tribe for the Department to analyze the plan thoroughly for its conformity to law and its equity. The Tribe agreed to any changes consistent with the principles of the plan, such changes to be retroactive to August 1.

Wyandotte Tribe of Oklahoma

The act of August 1, 1956 (70 Stat. 893), provided for termination of Federal trusteeship of the Wyandotte Tribe of Oklahoma on or before August 1, 1959. After settlement of 250 appeals, a final roll of the tribal membership was approved by the Secretary on January 29, 1959. This roll, containing 1,157 names, was published in the Federal Register on February 25, 1959.

The major remaining item in carrying out provisions of the act was disposition of the Tribe's Huron Cemetery, located in the heart of downtown Kansas City, Kans. A preliminary survey of the cemetery, conducted by the Department's Bureau of Land Management in February, revealed several encroachments on the property. An appraisal report received in May estimated the value of the cemetery with all graves removed, at \$291,000.

In June, the House Indian Affairs Subcommittee held a hearing in Kansas City on bills to make the cemetery a national monument but recommended no change in the 1956 act. A tribal referendum conducted in June revealed an overwhelming desire on the part of the members to sell the cemetery and distribute the net proceeds left after relocation of the graves. The members were told at that time that the pro rata distributions would probably not exceed \$300. At the completion of the hearings, the Muskogee Area Director moved to advertise the property.

Peoria and Ottawa Tribes of Oklahoma

In accordance with another termination act, that of August 3, 1956 (70 Stat. 937), the Bureau of Indian Affairs, through its Branch of Tribal Programs, completed the final roll of the Peoria Tribe of Oklahoma, consisting of 640 names. This was approved by the Secretary on April 15, 1959, and was published in the Federal Register on April 30, 1959. Pursuant to a third act of this kind of August 3, 1956 (70 Stat. 963), a final roll, consisting of 640 names of the Ottawa Tribe of Oklahoma was awaiting the Secretary's approval at the end of the fiscal year.

Tribal Government

To strengthen democratic procedures and improve administrative practices of the tribal organizations, the Bureau, in fiscal 1959, obtained final approval from the Secretary in some 50 instances of new tribal constitutions or amendments to tribal constitutions. In numerous cases the Bureau has worked closely with tribal groups and assisted them in devising special organizational



Through mobile school units, the Bureau of Indian Affairs is bringing educational advantages even to the most remote regions of the huge Navajo Reservation.

its or procedures which would facilitate the handling of their affairs.

Navajo-Hopi Rehabilitation

The Long Range Act, passed by Congress in 1950, authorized the appropriation of \$25,000,000 with which to finance the initial phase of a school construction program designed eventually to provide educational opportunities at an elementary- and high-school level for all school age Navajo children. During the period fiscal years 1951-58 inclusive, \$24,527,295 was made available for this purpose, and school enrollment was increased from 13,480 at the start of the 1951-52 school year to 28,043 at the close of the 1957-58 school year.

A specific action has been taken by Congress to increase the amount authorized for education construction purposes by the Long Range Act, but additional appropriated funds were made available in the amount of \$5,195,264 in fiscal 1959. These funds

were allocated for purposes of construction, advanced planning for trailer school relocation, and include money allocated for construction of the Leupp school (\$3,975,000), the Cove Day School (\$460,000), and the Jones Ranch School (\$350,000).

In addition to this Federal school construction, space for approximately 365 Navajo children was provided in public schools completed during fiscal 1959 at Tohatchi, Tse Bonita, Church Rock, and Fort Defiance (the latter is a school expansion project). In addition, five public school facilities with a total capacity of 200 Navajo students were in the process of building in 1959 at Fort Defiance, Chinle, Ganado, Tuba City, and Keyenta.

Irrigation Projects

The Long Range Act authorized the appropriation of \$9,000,000 for irrigation construction purposes on the Navajo Reservation. A total of \$4,337,775 was allocated for this purpose to the end of fiscal 1958, and with the addition of \$640,000 in fiscal 1959 the total stood at \$4,881,040. With the 1959 allocation, the following construction work was carried out.

1. *The Hogback project.*—A segment of main canal 2.7 miles in length, with 7 lateral turnouts, and 3.9 miles of laterals with 11 concrete drops were built under contract, and 817 acres of new land was subjugated. The newly developed farmland will be divided into 7 units which will be assigned to Navajos recently graduated from the Navajo Tribal Farm Training School at Shiprock, N. Mex. Total cost of this work was \$296,575.

2. *The Fruitland project.*—A total of \$45,000 was used for the replacement of old timber drops on this project.

3. *Construction Warehouse.*—With expiration of a lease on facilities owned by the Santa Fe Railroad and utilized by the Bureau of Indian Affairs for warehouse purposes, it became necessary to move the irrigation warehouse and shop to Shiprock, N. Mex.

Roads and Trails

The Long Range Act authorized appropriation of \$20,000,000 for necessary road and trail construction on the Navajo-Hopi Reservations, of which \$13,870,180 had been allocated by the end of fiscal year 1958. In 1959, with the allocation of an additional \$2,191,000 the total was brought to \$16,066,288.

Public Law 85-740 enacted in 1958 amended the Long Range Act authorizing the appropriation of an additional \$20,000,000 for the construction and improvement of Routes 1 and 3. Construction

authorizations to a total of \$1,980,000 were allocated for fiscal 1959, including the following projects:

1. Construction of the final segment of pavement on Route 3, involving 28.7 miles between Dinnebito Wash and Coal Mine Mesa.
2. The widening and placing of a plant mix on a segment of road extending 9.7 miles westward from the Arizona-New Mexico State line on Route 3.

Conservation and Range Improvement

The Long Range Act authorized the appropriation of \$10,000,000 for soil and moisture conservation programs on the Navajo-Hopi Reservations, of which \$4,646,625 had been allocated through fiscal 1958. With an allocation of \$570,617 in fiscal 1959, the total stands at \$5,217,242 since the inception of the 10-year program.

In conjunction with other funds (Federal and tribal) the 1959 allocation was used to carry out soil and moisture conservation work included under the 20-year development program. During the year, 128 land use plans were developed, 21,907 acres of undesirable brush was removed from reservation rangelands, 89 flood control dams and 69 storage dams were built and 1,152 educational meetings were held with Navajo communities.

Revolving Loan Fund

The Long Range Act authorized the application of \$5,000,000 to provide necessary credit to Navajo and Hopi Indians for the development of productive enterprises. During the period 1952-53, the Navajo Tribe borrowed \$700,000 from the Federal Government under this authorization, to which the Tribe added \$44,000 of tribal funds. A total of \$898,629.77 has been loaned to 976 borrowers, of which \$499,759.20 has been repaid since the inception of the program. During the past fiscal year, \$106,929.92 was loaned to 77 borrowers, and \$153,052.95 was received in loan repayments. There are currently 270 active loan cases.

Employment Assistance

In the field of employment assistance, the Bureau of Indian Affairs now provides the following types of opportunities for Indian people who qualify: (1) relocation for employment, (2) vocational training in non-Federal schools, (3) on-the-job

training in industrial plants, and (4) job placement within State of reservation residence.

The newest of these services is the last one mentioned. It initiated in fiscal 1959 in the States of Montana, Wisconsin, South Dakota where an experienced placement officer of the Bureau was assigned to work with the three State employment service. Indians on Montana reservations were helped to find jobs in Montana and a similar plan was followed in the other two States. During the first year jobs were located for 175 Indian workers in the three States and assistance in moving was provided to 350 people including family dependents.

Relocation Services

Because the market for unskilled and semi-skilled workers was quite limited in most "relocation cities" until the spring of 1959 the Relocation Services Program of the Bureau was carried forward at a somewhat reduced tempo during the fiscal year. Assistance was provided to 3,560 persons including 1,655 who relocated as family heads or as unattached individuals. The comparable figures for fiscal 1958 were 5,728 and 2,373.

The office at Cincinnati, Ohio, was closed in fiscal 1959 leaving a balance of nine offices operating in destination cities at the end of the period. These were Chicago, Ill.; Denver, Colo.; Los Angeles, Calif.; Oakland, San Jose, and San Francisco, Calif.; Cleveland, Ohio; Dallas, Tex.; and St. Louis, Mo.

In addition to the job market limitations, another factor accounting for the smaller volume of new relocations during the year was a recognition by the Bureau of the need for providing even better relocation applicants with greater service over a longer period in order to assure a successful adjustment. Increased emphasis was placed on the upgrading of relocatees' jobs, the improvement of housing accommodations, training in money management, and increased interest in savings accounts, encouraging night school training for adults, and stimulating interest and participation in community activities.

Adult Vocational Training

Interest in adult vocational training increased to such an extent that opportunity to file applications was made available to all



hundreds of Indians between 18 and 35 are acquiring new skills and improving their earning power through the vocational training program sponsored by the Bureau of Indian Affairs.

More comprehensive training opportunities have been developed. At present, there are 404 courses approved at 147 different institutions. Some of the most popular courses are: auto mechanics, welding, cosmetology, radio and TV repair, stenography, typing, and body repair. Approximately one-half of the applicants accepted and entered in training took vocational courses at institutions in their own States. There was a heavy carryover of trainees (in excess of 900) into fiscal 1960 which will limit the enrollment of new applicants. During the year, 1,547 trainees were enrolled

and assistance in moving was furnished to 3,094 persons including family dependents.

On-the-job Training

Interest in on-the-job training is growing, and this offers a special opportunity for employment on or near the reservations. Applicants for on-the-job training in industrial plants are screened by the Bureau of Indian Affairs and final selection of the worker is made by the plant management. In addition to the liaison work carried on with the employer, continuous counseling and guidance services are made available to the trainees. New units entered in this type of training consisted of 98 singles or family heads representing 196 persons. At present, there are nine contracts in effect. Additional contracts are in the negotiation stage.

Industrial Development

The purpose of the Industrial Development Program of the Bureau of Indian Affairs is to assist the Indian people in cooperating with their neighboring communities in the development of plans and programs which will attract industry to the reservation area and thus provide employment opportunities and improve economic and social conditions.

Fundamentally, two kinds of action are needed to increase industrial payrolls in the general vicinity of reservations: (1) providing information about the advantages that can be offered to firms that might locate in the community; and (2) taking the action necessary to create or improve local conditions which will make the community desirable as a manufacturing location.

To provide impetus in fulfilling these needs, industrial development specialists were assigned to special field offices in Chicago and Los Angeles and to six of the Area Offices. In addition, an industrial development specialist was assigned to work on a pilot project in cooperation with the North Dakota Economic Development Commission at Bismarck, N. Dak.

During fiscal year 1959, continuing progress was made in (a) educating tribal leaders in the basic concepts of industrial development and the need for cooperation with neighboring communities in creating the proper local environment conducive to industrial development and growth; (b) providing assistance to tribal and community groups in organizing and establishing industrial development foundations and similar entities to negotiate with industry.

(c) compiling statistical data and preparing industrial fact sheets and other related descriptive data concerning local industrial plans, resources and assets; and (d) developing prospects for on-the-job training projects which will provide employment prospects for Indian people on or near reservations.

The McNary Townsite in Oregon, surplus Government property made available through the provisions of Public Law 85-186 (August 28, 1957) to the Confederated Tribes of the Umatilla Reservation, Oreg., was leased to a California concern engaged in the manufacture of mobile homes. The official opening of the plant was held on February 25, 1959, and the first mobile home came off the assembly line on May 15, 1959, at a special ceremony. The plant opened with 26 employees and is expected eventually to provide jobs for about 200 workers. Indians are given preference in hiring.

The Eastern Band of Cherokee Indians recently entered into a 5-year lease with a manufacturer of bedding and quilts for 60 acres of land and a 75,000-square-foot building to be constructed on the Cherokee Reservation in North Carolina at a cost of approximately \$300,000. Upon completion of the building, it is expected that about 155 people will be employed, with preference given to members of the Eastern Cherokee Band.

Realty

During fiscal 1959, the following major developments took place: (1) The moratorium on Indian land sales, which was imposed May 28, 1958, in compliance with a congressional request was lifted and sales resumed under the Bureau's policy statement of May 12, 1958.

(2) Bureau and Departmental policies clarifying when individual Indians and tribes may acquire additional land in trust status and when they will be required to acquire their additional lands in a fee status were contained in a memorandum to all Area Directors, approved by the Assistant Secretary for Public Land Management April 22, 1959.

(3) Limited land sale moratoriums were declared on the Standing Rock and Lower Brule Reservations to allow Indians displaced by the Oahe and Fort Randall Reservoir takings to have first opportunity to relocate on reservation lands being offered for sale, and similar moratoriums were put into effect on the Omaha and Winnebago Reservations to allow the tribal councils to prepare detailed land consolidation programs.



One of the encouraging developments of the year was the establishment of a plant for the manufacture of mobile homes near the Umatilla Reservation in Oregon on land formerly used as the McNary Dam Toad site. Most of the employees are Indians.

(4) Allotting was completed on the Torres-Martinez Reservation in California.

(5) Instructions for the equalization of allotments on the Pecos Springs Reservation were approved and the preliminary work on supplemental allotments was in progress at the close of the fiscal year.

(6) A new section was added to the regulations, 25 CFR 121.10, to assure, insofar as practicable, that Indian applicants for patent-in-fee are informed concerning the disposition of their application before such information is made available to the general public.

During the year, the Bureau of Indian Affairs processed a total

10,976 realty transactions involving acquisitions and disposals, including 2,138 probate inventories. In total 547,763.39 acres of fee or restricted land were sold by their Indian owners. Of this acreage, 97,468.62 acres were acquired either by individual Indians or by tribes. Land sales on the Klamath Reservation in connection with the termination program accounted for 208,463.75 acres. In addition, 23,886.84 acres of fee or non-Indian owned lands were purchased and brought into either tribal or individual Indian ownership. Sales to unrestricted status at the request of Indian owners accounted for 1,335 approved transactions; issuance of patents in fee to Indian owners, removals of restrictions and certificates of competency for 780; exchanges and partitions for 531; purchases for 659; and other miscellaneous transactions for 1,005. In addition, 4,528 applications for various transactions were processed which were either disapproved or withdrawn.

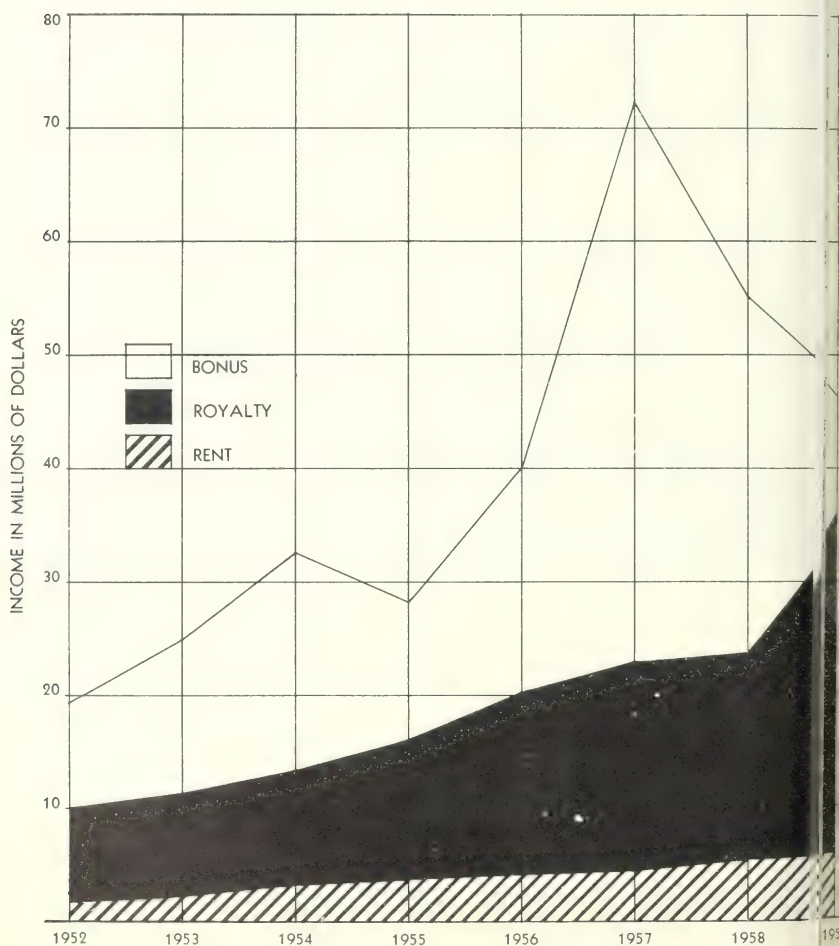
Minerals

There was a reduced demand for new oil and gas leases in fiscal 1959. On the Navajo Reservations, for example, only 109,323 acres were leased as compared with 382,373 acres for 1958. The bonus for Navajo leases for 1959 amounted to \$3,939,512, a decrease of \$1,56,887 from the prior year. Of interest was the Navajo lease held January 13, 1959, at which a bonus of \$5,505 per acre was paid for a 160-acre tract.

Although there was some reduction in the leasing of Navajo lands, the number of producing wells drilled on these lands increased from 66 to 771, and the royalty received by Indian owners increased from \$7,846 for the prior year to \$10,496,820. The success ratio of the oil wells is regarded as above the national average for the year. The new pipelines in operation for about a year encouraged the drilling of additional wells in the Aneth (Utah) and Horseshoe Canyon and Bista (New Mexico) areas on the Navajo Reservation. The second producing oil well in the State of Arizona was completed during the year on Navajo tribal land. The first oil well was drilled on Navajo tribal land in 1955.

The total income from bonuses, rentals and royalties on oil and gas leases and prospecting permits in fiscal 1959 amounted to \$4,37,458. In bonus income there was a reduction of almost \$200,000 as compared with fiscal 1958. The total rental increased about \$541,000. The royalty income, however, increased by more than 60 percent, advancing from \$18,453,532 in 1958 to \$30,172,382 for 1959.

In the exploration of minerals other than oil and gas, there has been little new development except the issuance of a preferential coal prospecting permit on approximately 85,760 acres of Navajo tribal lands in New Mexico. The permit provides for the selection of acreage for lease. It is contemplated that coal will be processed for two major purposes. One of these involves the production of gas to be mixed with natural gas carried in the lessee's pipeline which already cross the area; the other involves production of liquid hydrocarbon compounds of motor fuels and additional expected byproducts.



INCOME FROM OIL AND GAS OPERATIONS ON INDIAN LAND FOR FISCAL YEARS 1952-59

A total of 5,285,679 acres was under oil and gas lease at the end of fiscal year 1959, covered by 18,858 individual lease contracts

As the result of restrictions in the purchasing policy of the Atomic Energy Commission, there has been a marked decline in the acquiring of new uranium leases, and authority to shut down operations has been granted on a number of the existing leases. However, leases for 3,041.36 acres of allotted Navajo lands in McKinley County, N. Mex., were recently sold for a bonus of \$19,315.60. While the number of producing uranium leases on Indian lands has declined, there has been very little reduction in the tonnage mined as compared to the prior year. The royalty from the Jackpile uranium mine involving lands of the Laguna Pueblo, N. Mex., amounted to \$742,877 for this period.

Due to the poor market for lead and zinc, it has been necessary to grant shutdown permits on the marginal lead and zinc leases covering Quapaw Indian lands in Oklahoma.

The total income to Indian tribes and individuals from minerals other than oil and gas during fiscal year 1959 amounted to \$3,030,004. At the close of the fiscal year, there were 19,804 subsurface leases of all kinds in force and effect covering 5,459,040 acres of Indian-owned lands.

Records

During fiscal 1959, exploratory studies looking toward development of a modern and improved land records and title system were conducted on a continuing basis. The proposed system, patterned primarily on the Torrens method of recording land title transactions, includes the use of modern electronic data processing equipment in sorting and chronologically listing the great mass of title data affecting Indian lands.

A pilot test of the proposed system covering the Lower Brule Reservation in South Dakota will be installed in the Aberdeen Area Office early in fiscal 1960. The electronically listed title data, assembled from Central Office source title documents, will be audited against existing field records, and the system will be placed on an operating basis for this one reservation as a test of its practicability and overall adoption by the Bureau.

Title and Management

In fiscal 1959 the Bureau of Indian Affairs processed 2,120 cases granting rights-of-way over Indian lands for various purposes. Present statutory authority vests the power to grant rights-of-way on or across Indian lands in the Secretary of the Interior. With some exceptions, specifically mentioned by the statute, the grant

of right-of-way may be made only with the approval of the Indian owners. The authority of the Secretary to grant rights-of-way when such grants are in accordance with the prescribed regulations has been delegated to the operative field level.

At the close of the year there were 34,155 surface leases or permits of all kinds in force on Indian lands, covering 4,534,621 acres and providing an annual rental of \$9,444,065 for the Indian owners. These leases and permits cover the use of Indian lands for farmland, farm-pasture, grazing, and business purposes. They do not include lands incorporated in range units.

Long-term leases, authorized under the act of August 9, 1934, have been made on several reservations. Because the act of June 28, 1934 (48 Stat. 984) limits leases for 10 years when made with chartered tribes under the authority of their approved charters, there was considerable confusion over the effect of this statutory limitation after enactment of the 1955 statute. Solicitor's Opinion M-36515 of November 20, 1958, relating to the separability of the charter and the constitutional bodies of tribal government, served to clarify this situation by indicating that the 1934 act limitation applies only to tribal lands which have been formally transferred to the charter organization. Where the tribal constitution similarly restricts the duration of leases on tribal lands, the tribes desiring to enter into long-term leases will need to adopt appropriate amendments. Many tribes have already so amended their organic documents.

Forestry

Three important actions were taken in fiscal 1959 to improve the administration of Indian forests.

The most important was an amended delegation of authority approved by the Secretary of the Interior on November 20, 1958. It increased the authority previously delegated to the Commissioner of Indian Affairs, so he may now exercise the authority of the Secretary in relation to "all those matters set forth in 25 CFR Chapter I, Subchapter M—Forestry," and also "the adjustment of stumpage rates and the performing of all other administrative actions to be taken by the Secretary pursuant to timber sale contracts now in effect."

The administration of Indian forests, particularly the sale of timber, is simplified by this increased delegation of authority. Equally important, a meaningful appeals procedure is now possible. Under the limited delegation of authority previously in effect, many actions under timber sale contracts were taken at the Secretary's

cial level. There was no higher authority within the Executive Branch of the Government to which an appeal could be taken. Action is now taken by the Commissioner of Indian Affairs, or at subordinate levels. The Secretary is thus in a position to consider appeals from the Commissioner's decisions.

The second important action of the year was a complete revision of 25 CFR 141—The General Forest Regulations. The revised regulations were published in the Federal Register, as a proposed rule making. Following this publication, some minor changes were made. At the close of fiscal 1959 the Regulations, in final form, were being reviewed at the Secretarial level for approval. This is the first overall revision of the Regulations in nearly 25 years.

The third action was approval of standard forms of timber sale contract and a set of standard contract provisions. The approved forms of contract heretofore available could be used only in the sale of timber on trust allotments, and in small volume sale of tribal timber. For each separate large-volume sale it was necessary for the Commissioner or the Secretary to approve a special form of contract. There are now available approved forms of contract for both large

and many reservations, such as Colville in Washington, timber sales are the principal source of tribal income.



and small sales. The standard contract provisions replace the general timber sale regulations that were originally approved in 1914.

With the approval of these forms, the sale of timber is greatly simplified. Area Directors can now advertise timber sales and execute the contracts without first obtaining clearance from the Central Office, except that the Commissioner still approves sales covering estimated volumes exceeding 15 million board feet. However, a great majority of the sales are for less than this amount.

Timber Sales

The general improvement in business conditions, which began in the latter part of 1958, resulted in a modest increase in volume and value of timber sold from Indian lands. The volume of timber under contract increased from 425 million board feet in Fiscal Year 1958 to 530 million feet in 1959. Cash receipts from these sales increased from \$8¼ million to \$10 million. Sales of timber on Klamath Indian Reservations are not included in the foregoing figures because sales at that reservation were affected by the termination legislation.

A deduction, not exceeding 10 percent, is made from timber sale receipts to cover, in whole or in part, the cost of forest management and timber sale administration. After such deductions, net income to the Indians from sales of their timber in fiscal 1959 was somewhat more than \$9.1 million. About 72 percent of receipts (exclusive of Klamath) was from the sale of tribally owned timber. The remaining 28 percent was from sales of timber on trust allotments owned by individual Indians.

At many reservations, timber sales are the principal source of tribal income. Among such tribes are those of the Colville and Yakima Reservation in Washington, the Warm Springs in Oregon, the Hoopa Valley in California, the Flathead in Montana, the Gila River in New Mexico, the Menominee in Wisconsin, and the Fort Apache in Arizona. Without an income from their tribal forest lands it would be impossible for these tribes to finance their present activities.

Timber Inventories

Continuing progress was achieved during the year in obtaining timber inventories for forested reservations, and in revising timber sales schedules pursuant to information developed from them. The inventories have generally justified an increase in the annual timber

by the end of fiscal 1960, acceptable inventories should be available for most of the commercially important Indian forests on reservations under the Gallup, Muskogee, Phoenix, Portland, and Sacramento Area Offices. Major exceptions in these areas will be the lack of adequate inventories for the Mescalero Reservation in New Mexico, the Hualapai Reservation in Arizona, and the Quinault and Nisqually Reservations in Washington. An inventory has been started on the Quinault Reservation but may take as long as 2 years for completion.



In 1959 the Bureau of Indian Affairs continued its important timber inventory work on forested reservations.

Irrigation

During the 1958 crop year, 572,944 acres of Indian lands were irrigated. The gross production from this acreage was valued at \$56,305,434.

The construction and rehabilitation program, in addition to the annual maintenance program, continued with resulting improvement in efficiency in water use and better use of the Indians' soil resources. Major accomplishments were as follows:

| Irrigation: | New | Rehabilitated or repaired |
|--|---------|---------------------------|
| Irrigable acreage | 2, 470 | 4 |
| Canals and laterals (mi.) | 74 | 3 |
| Structures | 1, 145 | 1 |
| Wells and pumping plants | 40 | |
| Lining-canals and laterals (mi.) | 5 | |
| Drain ditch (mi.) | 24 | |
| Tile drains (linear ft.) | 45, 000 | |
| Power: | | |
| Customers | 444 | |
| Transmission lines (mi.) | 13 | |
| Distribution lines (mi.) | 41 | |
| Transformers | 334 | |

Among the major programs now under way are the rehabilitation work on the six Middle Rio Grande Pueblos; continuation of construction of the Navajo Hogback Extension in New Mexico and the Michaud Unit of the Fort Hall project, Idaho; continuation of the rehabilitation of Duck Valley, Nevada lands; and expansion and improvement of Colorado River drainage and water control facilities.

Range, Wildlife and Recreational Resources

After nearly three decades of range management under Departmental regulations, Indian reservations now have some of the best forage resources to be found in the western States. The progress made in good management is demonstrated by the condition of 4,800,000 acres of Indian grazing lands in North and South Dakota. It is estimated that 90 percent of these range lands are in good to excellent condition. The information furnished by range and wildlife surveys is making it possible to establish better grazing practices through educational work with the range users and through corrective location of range improvements.

In the Southwest drought and insufficient range resources to meet the needs of the Indians still present a serious management problem. This is especially true on the Navajo Reservation and on most of the New Mexico Pueblos. Encouraging progress is, however, being

le on a number of other southwestern reservations through the
tment of tribal ordinances and because the Indians are becom-
increasingly aware of the economic value of conserving their
ge.

ore than 80 percent of the Indian range is used by Indian live-
x operators. On reservations where there is range temporarily
xcess of the need of Indian livestock, the units are advertised
competitive bidding. The prices received for grazing privileges
through competitive bidding are often the highest received
in a particular State.

se of the Indian range resources for 1958 calendar year is as
lows:

TABLE 1.—*Use of range in units, 1958*

| | Acres (thou- sands) | Percent of acreage used | Livestock grazed (thousands) | Use value |
|------------|------------------------|-------------------------------|------------------------------------|-------------|
| ange | 41,319 | | | |
| se | 40,561 | 100 | 822 | \$5,422,000 |
| Indian use | 7,010 | 17 | 348 | 1,780,000 |
| use | 33,551 | 81 | 474 | 3,642,000 |
| ed | 758 | 2 | | |

n addition to the range resource, practically all Indian groups
e their wildlife and recreation resources. The Indians are be-
ing constantly more aware of these resources and are making
h for their better and wiser use. Table 2 indicates the values of
k resources at the present time.

TABLE 2.—*Fish and Wildlife—Approximate Income or Value of
1958 Harvest*

| | |
|---|-------------|
| all reservations | \$3,254,000 |
| Commercial fish | 413,000 |
| Dectic fish | 607,000 |
| Furbearing animals | 165,000 |
| Game birds | 354,000 |
| Big game | 1,572,000 |
| Rept from permits (fishing and hunting) | 143,000 |

gress made in soil and range inventories during 1959 is of
spial interest. The Bureau of Indian Affairs started making soil
ange surveys in the early 1940's. This work, in the beginning,
wa on a very limited scale but did furnish needed information for
har use and mangagement planning of individual tracts of land.
It as primarily a program of straight survey work. As the pro-
gram progressed, it was broadened to include the interpretation of
the llected information. Based on the experience gained in this
ear work, the program was reorganized in 1957 and emphasis

placed on greater use and understanding of the work by its users and on completing the soil and range inventories of each reservation by a target date of 1965.

During 1959, the Bureau had coordinated soil and range inventories with crews working on five Indian reservations. These crews mapped more than 31½ million acres during the year, representing approximately a 2-million acre increase as compared to 1958.

The year 1959 marked the completion by the Bureau of the coordinated soil and range inventory. This inventory was of the Colville Reservation. A complete report has been prepared and furnished to the tribe as a basis for developing plans for use and management of the soil, plant and water resources, and for planning readjustment programs. It is planned that similar reports to the tribal councils will be prepared for each of the other reservations as the inventories are completed. These inventories furnish Indian tribal groups, individuals, and technicians with essential information about resources that is needed for planning. However, to make maximum use of the inventories, it is necessary that users understand the meaning of the collected information and how it may be applied. As a part of the soil and moisture conservation program, tribal groups and individuals alike are helped to develop their knowledge of fundamental use and management facts and principles as they apply to resources. The explanation of soil differences and how these differences affect land use and management help the Indian people to understand the fundamental "why" of conservation.



Increasing numbers of Indian people are learning the value and techniques of crop improvement and soil conservation through demonstrations.

which is necessary to continued progress in the effective management of their resources.

Agricultural Extension

A total of \$984,689 was available for the Bureau of Indian Affairs' extension program in fiscal 1959. Of this amount, \$519,000 was allocated to 15 State extension organizations which provided assistance to Indian families under contracts with the Bureau. The Bureau continued to provide direct services in Arizona, Mississippi, and part of New Mexico.

In recent years the Bureau has placed increasing emphasis on the educational aspects of its extension work. Methods and procedures used by the various State land grant college extension organizations for regular extension work are being followed and adapted to the needs of Indian farm families. The Bureau has maintained a close working relationship with these State extension services as well as with the Federal Extension Service. Increased coordination in program development and execution is evidenced by a greater number of joint educational demonstrations and meetings held by these services.



Indian learning about the conservation problems of his kind of land.



Like other American youth, Indian youngsters on reservations have their own 4-H clubs. This is a "soil school" group at Pawnee, Okla.

The number of 4-H clubs has increased steadily with field activity being broadened to include greater opportunities for Indian youth training and development. In the State of Arizona alone, more than 25 percent of the State's total 4-H club membership consists of Indian boys and girls living on reservations.

Roads

Appropriations for the 1959 Bureau of Indian Affairs' road program were authorized in the Federal-Aid Highway Act of 1956. The act provided contract authorization of \$12,000,000 for reservation roads which includes \$2,600,000 for maintenance and \$9,400,000 for construction.

The \$2,600,000 road maintenance program provided maintenance on 16,950 miles of reservation roads and bridges in 20 States. The work included surface repairs, blading, repairs to drainage, clearing of right-of-way, and snow removal.

The 1959 road construction program consisted of projects totaling \$9,400,000. To accelerate road construction, this program was started during the last quarter of 1958 fiscal year by an advance of \$2,000,000 from the 1959 authorization. The construction work

Completed during the year included 326 miles of grading and drainage; 351 miles of surfacing; 2,687 feet of bridges; and 606 miles of surveys and plans for future projects.

During the past several years there has been a continual upgrading of construction standards on Bureau roads. This upgrading has been necessary to provide adequate roads to serve the increasing traffic volumes. Reservation road traffic has been changing in both volume and type. Higher standards have been required on many projects due to heavy truck traffic caused by the development of reservation resources.

Under the established Bureau policy of building roads up to an acceptable standard and transferring them to a local governmental authority for maintenance wherever possible, the Bureau's nationwide road system was reduced by 384 miles during the year.

Credit Activities

Continued progress was made in 1958 in helping the Indians and their organizations obtain financing needed to develop and utilize their resources, both physical and human. The major portion of their financing is now furnished by the same institutions that serve their citizens. Loans through the Bureau of Indian Affairs are made to Indians unable to obtain financing through customary credit agencies.

The activities of the Indians the past few years probably have been financed more adequately, and more sources of financing are now available to them, than at any time in their history. As an indication of the progress made, the following tabulation shows the increase in the amount of financing received by them at the close of the past 6 years.

| | Customary credit channels ¹ | Through Bureau | Total |
|-------|--|-------------------|--------------|
| ----- | \$22,315,851 | \$22,717,974 | \$45,033,825 |
| ----- | 27,665,135 | 21,449,804 | 49,114,939 |
| ----- | 33,959,558 | 27,149,696 | 61,109,254 |
| ----- | 55,725,811 | 29,961,299 | 85,687,110 |
| ----- | 59,424,956 | 30,344,983 | 89,769,939 |
| ----- | 60,998,783 | 30,557,150 | 91,555,933 |

¹ Figures are as of Dec. 31 of preceding calendar year.

Total financing in 1958 has more than doubled that of 1953. About 60 percent was furnished by customary lenders and about 33 percent came from tribal funds and loans through the Bureau.

Financing by Customary Financial Institutions

Primary emphasis in the Bureau's credit program is placed on encouraging and helping Indians and their organizations obtain financing from the same institutions that serve other citizens. Bureau personnel assist Indians in dealing with banks, product credit associations, building and loan associations, insurance companies, Federal and State agencies making loans, and other lenders. The trust status of some Indian-owned property, unfamiliarity of some Indians with procedures and requirements of customary lenders, and other such factors make it necessary to give some Indians special assistance.

Many Indians, however, deal with lenders on the same basis as other citizens. Consequently, complete information is not available on all financing furnished Indians by customary lenders. Available data, however, show that financing from these sources increased slightly more than 173 percent over the past 6 years. During 1958 the financing received from customary lenders increased a little less than 3 percent over 1957.

The act of March 29, 1956 (70 Stat. 62-63) authorized the extension and approval of mortgages and deeds of trust on individually owned trust or restricted land. Indians thus are now able to use their land as security for justified financing. The following shows the loans secured by trust land which were outstanding at the end of the past 3 years.

| Calendar year | Number of loans outstanding | Balance outstanding |
|---------------|-----------------------------|---------------------|
| 1956..... | 86 | \$ 7,600 |
| 1957..... | 103 | 8,600 |
| 1958..... | 113 | 9,000 |

Tribal Funds

Tribes with funds of their own available, are now required to use their own moneys to make loans to their members and to finance tribal enterprises, before applying for loans from the United States. The investments of the tribes in these activities total \$21,893,681 at the close of 1958. This was practically the same as the 1957 amount, \$21,875,815.

Revolving Credit Fund

Loans are made by the United States from this fund to tribes, other Indian organizations, and individual Indians. During 1958,

ditional amounts loaned totaled \$2,446,614. The amount loaned exceeded the prior year, 1957, by \$244,241 and was the largest in the past 6 years.

Repayments on loans during 1958 were \$1,946,951 which was \$70,000 less than in 1957. Thus the amount of the loans receivable at the close of 1958 was \$8,369,775, an increase of \$468,922 over 1957.

The amount delinquent increased from slightly less than 9 percent of the unpaid balance at the close of 1957 to slightly over 9 percent in 1958. Of the \$769,701 delinquent, \$110,883 was on loans made by the United States to individual Indians, mainly on loans to Navajo and Hopi colonists at the Colorado River Agency in the Phoenix area. A total of \$44,386 was on loans made to two cooperatives many years ago, which are uncollectible, but on which authority to charge off the debts is lacking. Tribes accounted for the balance, but \$34,690 of which was in the Juneau Area.

A reserve of \$1,344,343 has been established for potential losses on outstanding loans of \$8,369,775, or slightly more than 16 percent of the unpaid balance. Nearly 84 percent of this reserve was established because of potential losses on loans made in the Juneau Area.

Problem of Alaska Loans

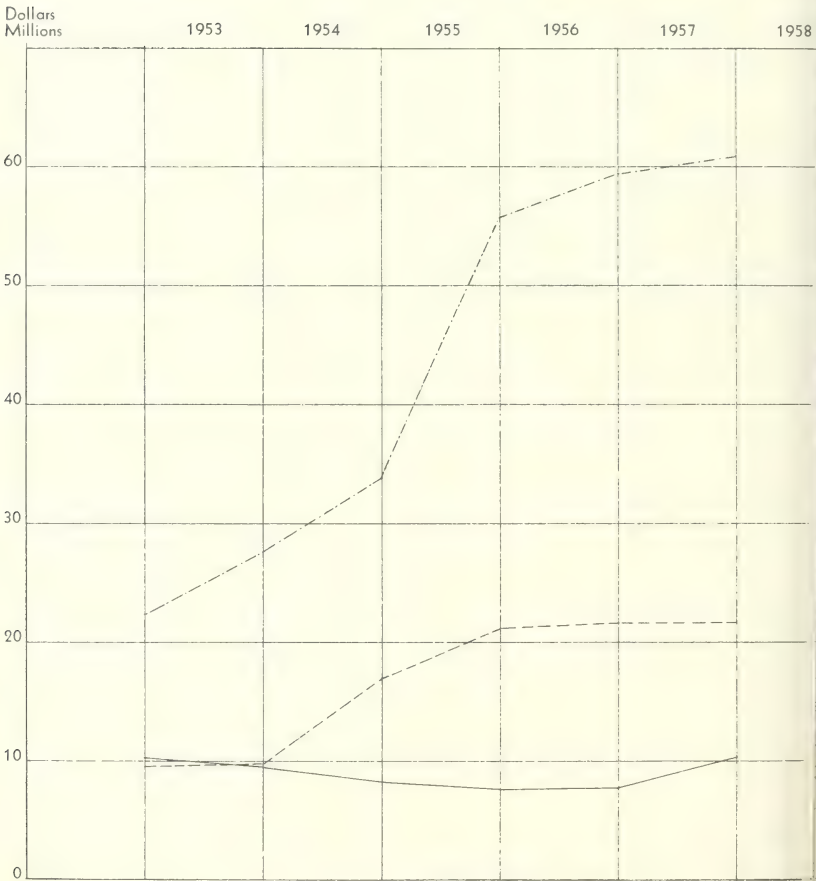
The Bureau is faced with a very critical and perplexing problem on some loans in Alaska. Large losses may be suffered. Four organizations have been declared in default, and are delinquent in payments totaling \$107,202. These, and the loans to four villages and salmon canneries are in critical condition and represent a large potential loss to the United States. The economy of the villages and the welfare of the Natives are vitally affected by credit operations in the Area and every effort is being made to protect and promote the economy of the Natives and the interest of the United States.

At the close of 1958, there was \$7,314,911 cash in this fund, against which there were outstanding commitments for loans of \$1,430,727. The cash balance remaining unobligated, \$1,333,995 was reserved for loans in Oklahoma, exclusive of Osage County, and \$378,587 was reserved for loans to Navajo-Hopi Indians and organizations of the Indians. A balance of \$4,171,602 was available for general credit use.

Since the close of 1958, the demand for loans has greatly increased. Loans to finance the 1959 operations of our Native-owned canneries in Southeastern Alaska total \$973,200. The Bureau is committed to making loans direct by the United States to individual Indians in

SUMMARY OF FINANCING RECEIVED BY INDIANS AND THEIR ORGANIZATIONS

Key: - - - - Customary Credit Channels (non-Bureau)
 ——— Revolving Credit Fund
 - - - - Tribal Funds



six localities including withdrawing members of the Klamath Tribe. A total of \$704,400 was made available for loans to the latter in fiscal year 1959, and it is estimated that over \$1,400,000 will be required in 1960.

Relending

Indian organizations use funds borrowed from the United States to make loans to members and associations of members, and to finance

business enterprises. Tribes use tribal funds for the same purposes. Organizations had cash totaling \$6,126,402 available for continuation of activities at the close of 1958. Amounts outstanding on loans June 30, 1958, were as follows: Loans to individuals:

| | | |
|--------------------------------|-------------|-------------|
| Cash | \$6,137,893 | |
| Livestock | 951,138 | \$7,089,031 |
| Loans to cooperatives | | 732,093 |
| Financing of enterprises | | 19,027,608 |
| Total | | 26,848,732 |

Loans to individuals.—The total unpaid balance at the close of 1958 was \$7,089,031 as compared with the balance unpaid June 30, 1957 of \$6,383,510. A total of 1,003 loans of \$2,543,276 was approved during 1958, against 1,068 loans of 2,408,999 in 1957. However, advances of \$318,558 had not been completed at the close of the year. There were 3,107 cash loans outstanding at the year's end. Payments totaling \$1,125,022 were delinquent, and \$534,257 was owing on loans in process of liquidation. Nearly 58 percent of the amount delinquent, and over 29 percent of the amount owing on loans in process of liquidation were in the Juneau area.

Potential losses on outstanding loans of \$6,137,893 were estimated at \$382,514, of which nearly 37 percent was in the Juneau Area. Slightly over 10 percent of the unpaid balance in the Juneau Area was estimated to be uncollectible. The comparable percentage for other areas was about 5 percent.

The total loans made during 1958 include 93 loans for educational purposes amounting to \$63,227 as compared with 164 loans for \$159,841 in 1957. Every possible effort is being made, by utilization of scholarships, grants, etc., to keep worthy Indian boys and girls in school without placing them in debt. Loans for educational purposes are approved only when other types of assistance have been exhausted.

The total of 189 of the unpaid educational loans with a balance of \$1,344 were owing to the United States, and 486 with a balance of \$341,376 were owing to Indian organizations. About 36 percent of the unpaid balance on loans by the United States and 20 percent of loans by Indian organizations were delinquent.

Loans to cooperatives.—The unpaid balance of \$732,093 is a small increase from the \$715,020 unpaid in 1957. The unpaid balance includes \$44,386 owed to the United States by two cooperative associations in Oklahoma, which is uncollectible. All other loans were current.

Financing of enterprises.—A total of \$19,027,608 was invested in enterprises at the close of 1958. The instructions in the

Bureau's manual were undergoing revision at the close of the fiscal year in an attempt to procure more accurate and uniform reports of the financing of enterprises. Generally, enterprises are those tribal business activities that are considered to be at least self-sustaining, which will produce a net income for the organization and promote its economic development. Activities involving welfare or social aspects of tribal activities are not included.

Budget and Finance

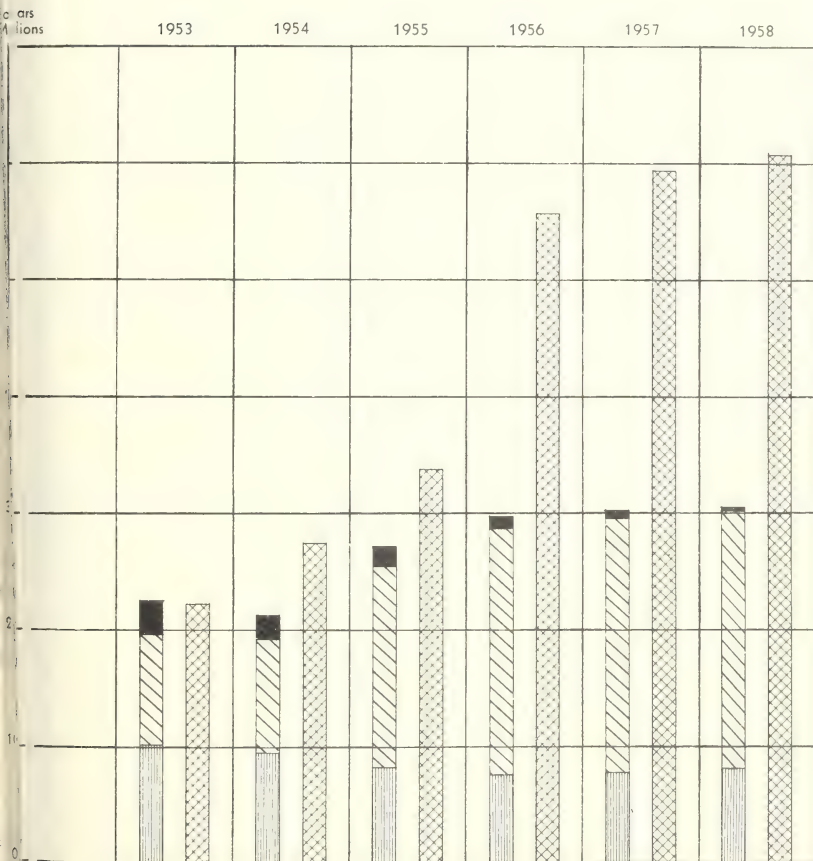
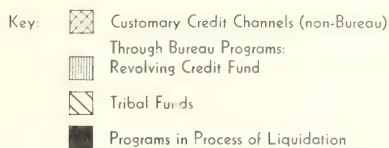
Gross receipts from the management of Indian lands and resources during fiscal year 1959 approximated \$80,247,500. Of this amount \$74,070,000 was deposited in the Treasury of the United States as a credit to the account of the various Indian tribes. The principal source of income deposited to the tribal trust accounts was from bonus and royalty payments from oil and gas and mineral lease for the amount of \$54,000,000, and from timber sales in the amount of \$11,500,000. The balance of approximately \$8,500,000 deposited to tribal accounts was from leasing of Indian lands for farming, grazing, and from other miscellaneous sources.

The various Indian tribes used approximately \$65,500,000 of their available funds for the operation of various programs for the benefit of their members. These included the operation of sawmills, tourist accommodations, and farming enterprises; the subjugation of lands; higher-education-tuition grants for Indian students; scholarship grants to needy members of their tribes; maintaining law and order and the operation of tribal courts; the general support of tribal governments and the many varied resources management programs operated by the tribes. The balance in trust accounts on July 1, 1959, was approximately \$141,753,768.

Personnel

The Bureauwide supervisory training program for some 100 supervisors was continued into its second year with major emphasis on personnel management and administration topics. All training materials used were developed within the Bureau. Participation in Departmental training programs was continued.

The Bureau augmented its promotion program and developed training material on this subject which was presented to all supervisors in the Bureau prior to the inception of the new program on January 1, in accordance with the Civil Service promotion program.

COMPARATIVE SUMMARY OF FINANCING RECEIVED BY INDIANS
AND THEIR ORGANIZATIONS

requirements. The basic soundness of the program is confirmed by acceptance on the part of employees and by the favorable remarks of Civil Service Commission inspectors.

Increasing effort was devoted in fiscal 1959 to developing classification and qualification standards with the Department and the Civil Service Commission. Major emphasis was given to standards for approximately 2,400 jobs in the professional education field. Im-

provements in the standards for teachers are expected to raise the caliber of the Bureau's teaching personnel.

Plant Design and Construction

Bureau construction in fiscal 1959 involved five new architectural and engineering contracts for the design of new school facilities and the supervision of 42 such contracts awarded in prior years. Fourteen design contracts were completed.

Educational and related facilities providing for 3,337 new pupils were under construction. Classroom space for 914 new pupils was provided by completion of 22 educational projects.

Construction was also in progress on miscellaneous facilities such as jails, fire lookout towers, sanitary facilities, and employee housing, mainly of the portable type.

The Bureau assisted the U.S. Public Health Service in the Indian Health Program by completing 19 construction projects and the supervision of 16 architectural-engineering design contracts for health facilities. Seventeen health facility projects were completed.

Plant Management

In 1959 considerable progress was made under plant management programs to find and eliminate unsanitary and unsafe conditions existing in most of the Bureau's older physical plant facilities. A comprehensive survey was undertaken to determine the corrective measures that are required to make buildings, utilities and service operations safe and sanitary. This survey gave primary emphasis to educational facilities; it included schools, kitchens and dining halls, dormitories, auditoriums, gymnasiums, assembly and recreational buildings in addition to such noneducational facilities as employees' clubs, jails, and utilities and related services. The survey did not include employees' residences, offices, general administrative type buildings or warehouses, garages and similar structures, or the utilities or services in connection with these facilities. In conducting the survey, consideration was given to reports made by the U.S. Public Health Service and State sanitary engineers and by sanitary engineers, Bureau boiler operation inspectors, Bureau electronic and mechanical engineers, Bureau structural and construction engineers and Bureau maintenance engineers.

The survey revealed a large number of defects which will require elimination or correction.

Future repair and maintenance and major repairs and improvements programs will give priority to further reducing the tremendous backlog of items requiring correction as reported in this survey.

Property and Supply

In fiscal 1959, the Bureau of Indian Affairs increased its participation in General Services Administration motor pool systems the transfer of 39 vehicles operated in Montana to the motor pool system at Billings.

The Bureau continued to reduce the size of its land holdings by conveyances, totaling 109.26 acres, to public school districts. Forty-nine Federal buildings located on tribal lands were also conveyed to Indian tribal groups under authority of Public Law 991, 74th Congress (70 Stat. 1057).

Increasing use of the mechanized property accounting system resulted in marked improvement which is reflected in audit reports.

Management Coordination

Only one important organizational adjustment was effected in the Bureau in fiscal 1959. The Osage Agency was transferred from the jurisdiction of the Anadarko Area to the Muskogee Area. The transfer was brought about to expedite administrative housekeeping functions. Such housekeeping functions for both Area Offices are now performed in Muskogee.

Mechanized Procedures

The Bureau continues to move forward in its exploration of applications of punchcard procedures.

Latest experimentation is in connection with realty records, distribution of income from range permits, and per capita payment systems.

The creation of a Branch of Mechanized Data Processing in the Gallup Area Office was initiated during fiscal 1959, and the top position in the Branch has been filled. Preparations such as the writing of detailed operating procedures, training of project managers, and recruitment of operators are now underway. The plan is to have the branch in partial operation by the end of the first quarter of fiscal 1960.

Reports and Forms Management

During the last three years nearly all Bureau forms currently in active use have been reviewed and revised for greater efficiency. In the last half of this fiscal year, representatives of all Central Office operating and administrative branches attended a series of forms improvement workshops conducted by specialists of the National Archives and the Department of the Interior. The workshops were held to extend to all Central Office staff some knowledge of the analysis and design of forms and the best procedures for their use.

The number and extent of the Bureau's reports remained unchanged since eliminations and reductions were balanced by additional reports required to evaluate new or revised Bureau programs.

Incentive Awards Program

The increase in employee participation in this program which began in fiscal 1956, has continued through fiscal 1959. The number of suggestions submitted in fiscal 1959 (1,195) was more than 11 times the number submitted in fiscal 1956 (108) and almost two and one-half times the number submitted in fiscal 1958 (458). The number of suggestions adopted has increased from 20 in fiscal 1956 to 956 in fiscal 1959.

The incentive awards program was effectively coordinated in 1959 with other management programs of the Bureau. This was accomplished by conducting training sessions on the incentive awards program as part of the Bureau's supervisory training program and by using incentive awards procedures in connection with the hazard elimination contest conducted as part of the Bureau's safety program.

Internal Audit

During 1959 Bureau auditors, working out of two audit field offices (at Albuquerque, N. Mex. and Billings, Mont.), completed audits of 9 of the 10 Bureau areas, all 10 field relocation offices, the Office of Plant Design and Construction (in Albuquerque, N. Mex.) and the Central Office. In addition audit assignments of a special nature involving tribal operations and enterprises, and privately owned concerns carrying on mining activities on tribal Indian lands were completed.

Inspection

The Bureau's inspection program has been functioning since 1955. Its purpose is to promote and encourage high standards of conduct in the management of Indian affairs throughout the Bureau in line with the announced policies of the Department of the Interior. The Inspection Office is primarily responsible for the conduct of "incident type" inspections, general inspection inquiries, and team surveys. During the past year the staff visited a number of field locations and filed 10 reports with the Commissioner concerning various matters of inspection interest.



Bureau of Land Management

Edward Woozley, *Director*



THE CONSERVATION JOB of the Department of the Interior's Bureau of Land Management stretches from the submerged lands of the coast of southern Florida to the permafrost of far-northern Alaska. It deals with fossil fuels being pumped from incredible depths of the earth's crust and the harvesting of forest giants whose topmost branches may rival the height of a 30-story skyscraper.

The conservation job covers the mining and extraction of non-renewable mineral resources and the planting of new seed for the perpetual crop of forests and grasslands. It includes the deliberate destruction of thousands of acres of poisonous rangelands and the care and protection of millions of acres from the destructive forces of fire, insects, and disease. The job involves setting some lands aside for parks and wildlife sanctuaries and making new lands available for new homes and towns and industries.

The conservation job covers more than 477 million acres in 28 States. These lands are the remaining public domain—public lands which are the wealth and heritage of all the people.

The conservation job of the Bureau of Land Management (BLM) is an important contribution to America's resource development. Last year the resource harvest from BLM lands included enough timber to build more than 100,000 average homes. Enough oil to heat more than 5 million homes for the next year. Enough forage to feed more than 11 million livestock and big game for an average of 18 months. And total receipts to the United States Treasury of more than \$136,700,000.

The conservation job which BLM did during the fiscal year ended June 30, 1959, is described in the following pages. In this finance the report reflects the growing importance of this

able publicly owned resources to the future growth and development of the Nation and its people.

Lands and Minerals

The lands and minerals activity of the Bureau of Land Management includes the complex array of classifications and field investigations, adjudication, and a records modernization program, as well as the public service operations of the Bureau's Land Offices. Total BLM appropriations for the lands and minerals activity amounted to \$6,710,400 for fiscal year 1959.

Lands

The approximately 477 million acres of vacant, unreserved, appropriated public domain lands in the United States are being used to help fill the needs of a growing population and expanding economy.

Last year the Bureau of Land Management issued 12,904 patents (deeds) transferring 763,192 acres to non-Federal ownerships. This included 83,457 acres of agricultural lands, and 15,024 acres of mineral lands, with the balance covering classifications and ranging from thousands of sites for summer homes to a land exchange for a giant new industrial plant.

Legislation

Far reaching legislative proposals were enacted or advanced during the year, foreshadowing fundamental changes in the public land situation in the near future. Foremost was the admission of Alaska into the Union (Public Law 85-508, July 7, 1958) with land grants to the new State totaling 103,350,000 acres. The size of the area, coupled with the fact that the State will have the right to choose from the best lands available, with few restrictions as to size, shape, and survey status, means that the State will probably be a dominant future influence in the lands picture of Alaska. Residents of Alaska during the year initiated their own homestead rush, perhaps in the belief that the Statehood Act would mean a marked decrease in homesteading opportunities under Federal law.

The Congress enacted a measure which should bring an end to the satisfaction of land grants to the States other than

Alaska. Public Law 85-771 (August 27, 1958) established new rules for the selection of lands from the vacant public domain to replace lands in earlier school land grants which the States had not received.

The new law corrected certain inequities and modified selection rights for State-owned lands within Federal reservations. The law permits States to select mineral lands when the original granted lands absorbed in Federal reservations also contain minerals. The State may also select lands under a Federal mineral lease if the lands are not already in production. Closing of the State land grant accounts is desirable both to insure that the States receive all the lands they were granted and also to end the disturbing influence that unsatisfied grants have had on public land management and disposition programs.

Another enactment of significance was the amendment of the Desert Land Act to permit entry of disconnected tracts under certain conditions and further encourage reclamation of arid lands (Public Law 85-641, August 14, 1958).

The settlement laws of Alaska were amended to permit acquisition of the surface of lands valuable for coal, oil, or gas. This amendment (Public Law 85-725, August 23, 1958), will encourage development of Alaska and protect the investments of developers of lands which turn out to be valuable for these minerals.

Another important legislative act extended the land leasing provisions of the Recreation and Public Purposes Act to the Oregon and California Railroad grant lands (O&C) in western Oregon (Public Law 86-66, June 23, 1959).

By the end of the year, the Congress had taken partial action on several legislative proposals of the Department. Of particular interest was the proposed Urban and Business Sites Act. The law would apply the first new concept of public land disposition since the Small Tract Act of 1938. The bill recognizes the growing importance of the public lands in the industrial and residential future of the country.

The proposed bill would provide three ways of making public lands available for residential and commercial purposes. Lands could be sold to local governments. Lands could be sold outright at public auction, or lands could be leased or sold in lots or blocks. Another bill in Congress would revise the public land townsite laws by substituting one modern law for a host of outdated existing laws.

Another legislative proposal of great interest would lift the present 640-acre limitation imposed by the Recreation and Public Purposes Act on the amount of Federal land a State may obtain

annually for park purposes. The present limit has seriously hampered many State park programs.

The Department also sponsored proposed legislation to provide authority for more efficient public land administration.

Embodying a 5-point program, the proposed bill would authorize the Secretary of the Interior to:

1. Study and enter into cooperative agreements in carrying out his responsibilities on Bureau of Land Management lands.
2. Modernize provisions for the payment of fees required as service charges.
3. Use forfeited deposits to rehabilitate lands damaged by defaulting timber purchasers.
4. Accept donations for improvement or management of public lands under his jurisdiction.
5. Require users of BLM roads or trails to deposit sufficient money for adequate maintenance.

Regulations

Final regulations were adopted under which Alaska will select more than 103 million acres of Federally-owned lands it was granted upon admission to the Union.

The Alaska statehood legislation did not specify the lands to be transferred to State ownership and the new State will have 2 years to select the granted lands. The regulations spell out the procedures which the new State must use. The regulations comply with the Alaska Statehood Act and give the details by which the Department of the Interior will handle State selections. The regulations also incorporate previous rules relating to two earlier land grants.

A comprehensive and more flexible system of controlling billboards on Federal lands will result from proposed regulations conforming to standards set for the interstate highway system.

The proposed regulations provide for close coordination between public land billboard and advertising standards set up by the Department of Commerce as part of the expanded Federal highway program and the standards set by State and local authorities for other highways and roads. The regulations would also permit additional standards as necessary in particular circumstances.

Other new regulations adopted during the year included Circular 2012 relating to rights-of-way. These regulations facilitate the use of a right-of-way (either applied for or granted) by authorizing an additional right-of-way ingress and egress when required.

Circular 2013 spelled out the procedure for agencies to relinquish

drawn or reserved Federal lands so that appropriate disposition may be made.

sification and Adjudication

The land classification process to determine the highest and best use of land is a basic part of the Bureau's land management job. The classification program for fiscal year 1959 resulted in 20,337 separate investigations and classifications. Improvement of the techniques and standards for land classification continued during the year.

The present classification activity is divided into two major programs. The first includes all of the classifications required to process pending individual applications. The second is classification prepared on "Bureau motion." The Bureau motion classifications are made before applications have been received from the applicant. Under the second program areas can be investigated and classified for management or for transfer to appropriate forms of ownership in an orderly and efficient manner.

An example of the latter type of classification action is the classification of areas suitable for development or disposition under the Small Tract or the Recreation and Public Purposes Acts. Another important example involves areas of isolated remnants of public land which can be classified as suitable for public sale. Often-scattered and isolated tracts do not usually fit into management plans for other Federal lands.

The results of BLM's land adjudication program are shown in the accompanying table. Behind the apparent progress shown by the figures is the fact that more than 50 percent of all the land applications have resulted in an unfavorable classification and subsequent denial of the application. Much of this is the direct result of applicants having filed applications in the mistaken belief that it is possible to obtain "free" or inexpensive lands from the Federal Government or, at least, to obtain Federal lands for less than the lands are actually worth.

This orderly approach to action is also being stressed in the adjudication segment of the Bureau's lands program. An example of the current emphasis on the termination of certain antiquated claims such as State lieu selections, scrip applications, and vacant lot sales.

There is a joint adjudication and classification effort to handle these tasks so that more emphasis may be given to the more important programs.

Adjudication of lands cases, Bureau of Land Management, fiscal year 1959

| Type of case | Unclosed cases July 1, 1958 | New cases during year | Reactivated cases during year | Cases closed during year |
|--|-----------------------------------|-----------------------------|-------------------------------------|--------------------------------|
| Title transfers: | | | | |
| Homestead..... | 1,958 | 2,183 | 2,810 | 3,974 |
| Desert land..... | 6,830 | 3,575 | 1,056 | 4,705 |
| Public sales..... | 3,306 | 2,301 | 162 | 2,008 |
| Selections..... | 1,124 | 519 | 37 | 436 |
| Exchanges..... | 969 | 338 | 122 | 481 |
| Land title cases..... | 2,613 | 3,611 | 958 | 3,903 |
| Small tract (unclassified land)..... | 19,436 | 5,188 | 630 | 4,024 |
| Small tract application and drawing (classified land)..... | 6,105 | 1,665 | 6,648 | 9,115 |
| Small tract (auction)..... | 128 | 1,270 | 110 | 1,166 |
| Small tract (options)..... | 7,460 | 38 | 6,647 | 8,604 |
| Recreation and public purposes sales..... | 300 | 188 | 137 | 171 |
| Total title transfers..... | 50,229 | 20,876 | 19,317 | 38,587 |
| Leases and permits: | | | | |
| Nonmineral leases..... | 108 | 60 | 24 | 84 |
| Rights-of-way..... | 2,078 | 1,732 | 793 | 2,943 |
| Nonmineral permits..... | 711 | 457 | 558 | 1,128 |
| Nonmineral material sales..... | 84 | 145 | 70 | 286 |
| Recreation and public purposes leases..... | 68 | 49 | 25 | 43 |
| Small tract leases..... | 68 | 100 | 143 | 152 |
| Total leases and permits..... | 3,117 | 2,543 | 1,613 | 4,636 |
| Investigations: | | | | |
| Trespass..... | | 8 | | 4 |
| Other..... | | 123 | 182 | 174 |
| Total investigations..... | | 131 | 182 | 178 |
| Other tenure actions: | | | | |
| Withdrawals and reservations..... | 981 | 426 | 34 | 500 |
| Revocations and restorations..... | 398 | 305 | 12 | 283 |
| Offers of excess land..... | | 5 | 1 | 3 |
| Total other tenure actions..... | 1,379 | 736 | 47 | 786 |
| Total..... | 54,725 | 24,286 | 21,159 | 144,187 |

¹ An additional 669 cases were closed by inventory.

The State lieu selection program, where States are selecting to replace others which were granted but not received, should close to completion within the next 5 years. Idaho and Arizona are inventorying the extent of the lieu selections to which they are entitled and should begin their selections soon. Arizona's selections are 50 percent complete and should be completed by 1963.

After building up a substantial backlog of applications, California has not filed any new applications for several years. The backlog has been cut down substantially. The remaining applications are involved in complex appraisals, trespass, surveys, mineral contests.

Since 1938 the Bureau's small tract program has resulted in the transfer of nearly 35,000 tracts to private ownership. These tracts are now being used as homesites, and for many forms of business and recreational use.

During fiscal year 1959, 9,091 small tracts were patented. This equivalent to transferring title to the entire residential portion of a city the size of Cheyenne, Wyo.

In addition, many new areas are now being surveyed and subdivided for future sale. The bulk of the small tract program is concentrated in the southwest. The overall program is swinging toward direct sale of tracts through public auction and away from lease with option to purchase. This trend has been well received by the public.

In some areas heavy and uncontrolled small tract filings prevented an organized and orderly program. To remedy this situation areas in southern California and Nevada were closed to new applications under the Small Tract Act. High priority has been given to processing old applications and at the same time making additional tracts available on the Bureau's own motion.

Classification and adjudication activities have been doubly complicated on desert land applications due to the action of promoters and so-called land locators. These promoters have encouraged people to file applications by giving them false assurance that through very little effort or expense they will obtain "free" Government lands.

The classifications required for areas included in pending applications under the desert land law have represented a significant workload. Many adverse classifications have been made and a large number of applications rejected. In one action BLM's Los Angeles Land Office rejected some 1,000 desert land applications involving about one-third of a million acres of southern California lands.

As an example of desert land activity in California, several years ago 99 entries were allowed in Chuckawalla Valley, in southern California. Thirty-two have already been canceled for failure to make annual proof. Only three have indicated total compliance with the desert land law. The remainder are still pending. None of these entries shows evidence of successful agricultural development. In spite of such facts locator activities in this general area have been on the increase.

Private exchanges under Section 8 of the Taylor Grazing Act constituted a significant portion of the Bureau's land classification program during fiscal year 1959. Most of these exchanges were small transactions to consolidate land ownerships and improve the pattern of public lands. However, large exchanges were completed which in some cases made important additions to national wildlife and recreation areas and other reservations. Colorado's Great Sand

Dunes National Monument and Montezuma National Wildlife Refuge both benefitted from such exchanges.

Public Recreation Land Use

The need for additional land for public recreation purposes is a critical national problem. Increasing population, personal income, leisure time, urbanization, and vacation travel will continue to aggravate the problem. Public domain lands administered by the Bureau of Land Management are already making important contributions to needed recreation areas.

Inventory was started of public domain lands having some special attraction which makes them suitable for intensive public recreation use. In the inventory particular attention was given to coast frontage and inland water shores and access lands.

The Bureau of Land Management has begun action to set aside a number of Pacific Coast public lands found valuable for recreation purposes in a Pacific Coast Recreation Area Survey conducted by the Department of the Interior's National Park Service. In northern Nevada several limestone cavern areas of possible national significance were classified for recreation.

Recreation on public lands is growing at a fast pace. BLM is helping to make lands available for recreational development by States, counties, and civic groups.



The recreation land utilization program of the Bureau is a cooperative effort to afford suitable public lands to State and local governments for development. The results in a few States illustrate effectiveness.

In California, a possible State park was identified along the Smith River and reported to the California outdoor recreation planning committee. In Oregon a redwood grove was set aside in the Big Trees Area so that it could be added to a State park. In Washington large tracts were classified on Pearygin Lake for a public park, and on the Yakima River for a game area.

A cooperative effort was initiated to develop and maintain areas already receiving heavy recreation use along the Salmon River in Idaho. A potential historic monument was brought to the attention of the Arizona Recreational Committee. In Utah large areas were made available for State parks in rugged and colorful Snow Canyon, and at Dead Horse Point overlooking the spectacular Grand Canyon of the Colorado. Fifteen potential areas in Colorado were studied for possible inclusion in a State park system.

Interest of local governments in recreation land is high. Local agencies are beginning to realize that unless the lands and waters needed for public recreation are acquired now, it may be too late. There is growing competition for attractive lake shores, wild coastal areas, and accessible wooded lands. They also realize that there is high cost in waiting to acquire desirable recreation areas. Vacant and unreserved land most suitable for public recreation will be classified by the Bureau for lease or purchase by State and local governments, and nonprofit organizations under the Recreation and Public Purposes Act. Land is made available at reduced price by this act under conditions which insure its use for public recreation.

Withdrawals and Reservations

During the past year, 221 public land orders withdrew 1,350,746 acres of public domain lands and restored 958,510 acres from their withdrawn status.

Of the areas withdrawn, several were of significant size. For example, almost 124,000 acres were set aside for the Atomic Energy Commission operation near Arco, Idaho. Approximately 443,000 acres were set aside for the Marine Corps at Twentynine Palms, Calif., for training purposes.

Slightly more than 250,000 acres in national forests were further withdrawn from the operation of the mining laws for recreation areas, campgrounds, scenic strips, and administrative sites. Among

the areas withdrawn were lands at the site of the 1960 Winter Olympic Games in California. The Ancient Bristlecone Pine Forest, whose trees are believed to be the oldest living things on earth, was proposed also. Over 72,000 acres were withdrawn for recreation purposes.

A review of existing withdrawals and reservations progressed this year. Its purpose is to reduce withdrawals to the minimum acreage required to adequately serve their purposes. It will promote increased multiple uses consistent with the primary uses of the withdrawn lands, and eliminate withdrawals no longer needed.

A total of 24,652,967 acres in withdrawals were reviewed. Of this total, 10,719,079 acres were determined to be in accord with public need and 13,354,515 acres in need of adjustment. Holders of withdrawals have requested the elimination of 1,223,626 withdrawn acres, reductions affecting 1,248,608 acres, and modifications of 4,058,663 acres.

Minerals

From the public lands come minerals and fuels for the Nation's industries—oil, natural gas, lead, zinc, copper, manganese, uranium, sulphur, sodium, potash, and others.

The public lands are known to contain a significant part of the unexplored and undeveloped mineral resources of the United States. These lands are being increasingly looked to as a source of future supply for the raw mineral materials needed for the Nation's growth.

Accomplishments

Mineral production from public lands during the last year reached a new high as the mineral leasing operations of the Bureau of Land Management continued to expand. From the public lands came more than 142,320,231 barrels of petroleum; 445,748,095 MCF (thousand cubic feet) of natural gas; 10,821,633 short tons of potash.

Oil and gas leasing of public domain lands has reached the highest point in history. Since 1945, when some 8,000 leases had been issued on about 4,500,000 acres, oil and gas leasing on June 30, 1960, reached a record total of 131,974 leases covering 107,155,290 acres.

The State showing the largest increase in leased land is Alaska where 32,100,429 acres are under oil and gas leases. A year ago Alaska reported 19,552,999 leased acres. Wyoming followed Alaska in acreage under lease with 23,581,232.

At the same time leases on so-called acquired lands has increased from 162 leases covering 200,000 acres in 1947 (the year when the Mineral Lands Leasing Act was passed) to the 1959 total of 42 leases embracing 4,684,047 acres.

Coal, potash, phosphate, and sodium activities have also increased. There are presently 191,936 acres; 142,874 acres; 48,978 acres; and 322 acres, respectively, under lease for these minerals.

Revenues received under the mineral leasing acts, including rentals, royalties and bonuses totaled \$95,877,122. The 1958 receipts were \$369,102.

Indication of minerals cases, Bureau of Land Management, fiscal year 1959

| Type of case | Unclosed cases July 1, 1958 | New cases during year | Reactivated cases during year | Cases closed during year | Unclosed cases June 30, 1959 |
|---|-----------------------------|-----------------------|-------------------------------|--------------------------|------------------------------|
| Transfers: | | | | | |
| Mineral entries (BLM and other)..... | 396 | 213 | 118 | 225 | 502 |
| Mineral entries (Forest Service)..... | 240 | 83 | 35 | 95 | 263 |
| Land disposal conflicts..... | 931 | 557 | 245 | 592 | 775 |
| Mineral classification..... | 141 | 104 | 1 | 140 | 106 |
| Total title transfers..... | 1,708 | 957 | 399 | 1,052 | 1,646 |
| Permits and leases: | | | | | |
| Oil and Gas non-competitive (Public domain) } Total | 18,432 | 55,956 | 24,914 | 81,233 | 18,069 |
| Oil and Gas competitive (Public domain) } Total | 2,372 | 2,002 | 1,553 | 3,687 | 2,240 |
| Oil and Gas non-competitive (acquired lands) } Total | 5,850 | 28,063 | 26,652 | 7,261 | 7,261 |
| Oil and Gas competitive (acquired lands) } Total | 22 | 3,767 | 3,789 | 3,789 | 3,789 |
| Oil and Gas overriding royalty assignments..... | 309 | 23 | 89 | 184 | 57 |
| Other permits and leases..... | 211 | 202 | 215 | 310 | 318 |
| Coal..... | 496 | 652 | 378 | 1,105 | 421 |
| Potassium..... | 27 | 20 | 20 | 41 | 26 |
| Phosphate..... | 1,209 | 376 | 157 | 857 | 885 |
| Sodium..... | 992 | 137 | 462 | 1,111 | 480 |
| Hardrock..... | 36 | 94 | 63 | 154 | 39 |
| Mineral material sales (common varieties)..... | 17 | 23 | 17 | 24 | 33 |
| Outer Continental Shelf (Sec. 6)..... | | | | | |
| Total permits and leases..... | 29,973 | 91,315 | 27,868 | 119,147 | 29,829 |
| Reimbursable investigations: | | | | | |
| Surface management (BLM and other)..... | 1,377 | 1,050 | 49 | 1,309 | 1,167 |
| Surface management (Forest Service)..... | 5,833 | 6,331 | 1,364 | 3,474 | 10,054 |
| Watersite mining claims (BLM)..... | 745 | 638 | 560 | 1,208 | 735 |
| Watersite mining claims (Forest Service and other)..... | 104 | 110 | 63 | 221 | 56 |
| Mineral claims and leases..... | 167 | 166 | 3 | 155 | 181 |
| Multiple use conflicts (non-disposal)..... | 60 | 208 | 701 | 117 | 852 |
| Special laws..... | 498 | 1,268 | 41 | 635 | 841 |
| Uranium-coal mining claims..... | 116 | 150 | 1 | 267 | ----- |
| Total investigations (non-reimbursable)..... | 8,900 | 9,921 | 2,782 | 7,386 | 13,886 |
| Reimbursable investigations..... | 3,343 | 3,157 | 39 | 3,062 | 3,477 |
| Total..... | 43,924 | 105,350 | 31,088 | 130,647 | 48,838 |

Additional 877 cases were closed by inventory adjustment.

Mineral Leasing in Alaska

At the close of fiscal year 1958 Congress was considering legislation which would raise oil and gas leasing land rentals and royalties.

Areas leased and bonuses received, competitive mineral leases, Bureau of Land Management, fiscal year 1959

| Type of mineral and State | Public domain lands | | Acquired lands | | Total | |
|---------------------------|---------------------|----------------|----------------|----------------|--------------|----------------|
| | Acres leased | Bonus received | Acres leased | Bonus received | Acres leased | Bonus received |
| Oil and gas: | | | | | | |
| Alaska..... | 16,610.00 | \$223,795.16 | | | 16,610.00 | \$223,795.16 |
| Arkansas..... | 160.00 | 1,008.00 | | | 160.00 | 1,008.00 |
| Colorado..... | 2,351.00 | 157,014.00 | | | 2,351.00 | 157,014.00 |
| Kansas..... | 360.09 | 14,759.52 | | | 360.09 | 14,759.52 |
| Louisiana..... | 649.69 | 4,606.51 | | | 649.69 | 4,606.51 |
| Mississippi..... | | | 243.75 | 3,704.28 | 243.75 | 3,704.28 |
| New Mexico..... | 4,210.00 | 360,431.00 | | | 4,210.00 | 360,431.00 |
| Oklahoma..... | 40.00 | 4,040.00 | 160.00 | 613.00 | 200.00 | 4,653.00 |
| Utah..... | 680.00 | 14,614.60 | | | 680.00 | 14,614.60 |
| Wyoming..... | 6,258.51 | 82,213.10 | 560.00 | 16,031.80 | 6,818.51 | 98,244.90 |
| Total oil and gas..... | 31,319.29 | 862,481.89 | 963.75 | 20,349.08 | 32,123.04 | 882,830.97 |
| Coal: | | | | | | |
| Colorado..... | 3,556.00 | 73,324.00 | | | 3,556.00 | 76,344.00 |
| Oklahoma..... | 1,680.00 | 1,764.00 | | | 1,680.00 | 1,764.00 |
| Utah..... | 80.00 | 80.00 | | | 80.00 | 80.00 |
| Wyoming..... | 2,769.29 | 146,011.43 | | | 2,769.29 | 146,011.43 |
| Total coal..... | 8,085.29 | 224,179.43 | | | 8,085.29 | 224,179.43 |
| Potash: | | | | | | |
| Idaho..... | 2,480.00 | 4,992.00 | | | 2,480.00 | 4,992.00 |
| Montana..... | 1,272.90 | 2,550.00 | | | 1,272.90 | 2,550.00 |
| Total potash..... | 3,752.90 | 7,542.00 | | | 3,752.90 | 7,542.00 |
| Sodium: | | | | | | |
| Wyoming..... | 8,636.90 | 74,126.22 | | | 8,636.90 | 74,126.22 |
| Grand total..... | 51,794.38 | 1,168,329.54 | 963.75 | 20,349.08 | 52,598.13 | 1,188,678.62 |

¹ Bonus forfeited, no lease issued on 160 acres.

ties in Alaska to the same level as those charged in other States. When fiscal year 1959 opened all oil and gas leasing in Alaska had been temporarily suspended (since May 2, 1958) while the legislation was before the Congress.

On July 3, 1958, Public Law 85-505 raised first-year lease rentals from 25 cents an acre to 50 cents an acre. The new rate was made effective as of the date leasing was suspended. The special Alaska royalty rate of 5 percent for the first 10 years was also raised to equal the 12½ percent charged elsewhere.

On September 3, 1958, the first competitive oil and gas leasing sale was held for Alaska lands. The area involved was some 16,000 acres in the Gubik gas field, located in north-central Alaska. At the sale 26 parcels were leased for \$223,795 in bonus bids and \$16,610 in rentals.

Also opened to noncompetitive mineral leasing were about four million acres adjacent to the Gubik area—all lands within the area known as PLO 82. Nearby Naval Petroleum Reserve No. 4 was not involved in any of the leasing actions.

Three development contracts have been entered into by the Interior Department involving four major oil companies which will result in

the extensive exploration for oil and gas in previously undeveloped areas in Alaska. The contracts affect lands in widely separated parts of Alaska including 455,573 acres in the Becharof-Egegik area on the north side of the Alaska Peninsula, 229,000 acres in the Knik Arm area off Cook Inlet north and west of Anchorage, and 490,000 acres in the Katalla-Yakataga areas in southeastern Alaska.

Development contracts provide for oil and gas exploration, development and operation of the included areas by a single operator or holders of oil and gas leases who commit their leases to the contract. Such contracts do not grant exclusive drilling rights within the described area. Each lessee within that area is free to develop his own leasehold interest.

Operations under development contracts are exempt from the acreage limitations prescribed by the Mineral Leasing Act. The contracts do not change the rental and royalty rates. The large acreage committed to this kind of development program is necessary to warrant the investment of the capital necessary to carry on exploratory work in areas on which so little geologic information is presently available.

Wildlife Land Classification

A study of oil and gas leasing on lands set aside and administered for wildlife conservation purposes culminated in the adoption of special lease stipulations. The new rules assure full protection of the wildlife values and at the same time permit satisfactory development of the oil and gas deposits. Special classification studies are made of these wildlife areas to determine which areas can be opened to leasing without impairing the usefulness of the lands for wildlife conservation.

Approximately 1 million acres in the Kenai National Moose Reserve in Alaska were opened to oil and gas development during the past year. The remaining 1 million acres were closed to leasing because such activities would be incompatible with management for wildlife purposes. Similar classifications have been made of the Desert Game Range in Nevada, and classification agreements have been reached on several areas in California.

Acreage Limitation Enforcement

Action has been taken to enforce compliance with the acreage limitation prescribed for oil and gas leases under Section 27 of the Mineral Leasing Act. Since 1954 the acreage that may be subject to oil and gas leases by an individual or company has been

46,080 acres in any one State (except 100,000 acres in Alaska). Prior to that time the limitation was 15,360 acres.

On January 8, 1959, regulations were amended to require closure of all parties having an interest in an offer to lease as well as lease assignments (transfers). The new rules also establish a procedure for cancellation and forfeiture of interest held in excess of the acreage limitations.

Three contest proceedings have been initiated (two in Wyoming and one in Montana) against parties who are alleged to have obtained excess lease holdings either in their own name or through dummy applicants, relatives, friends, and employees.

An acreage control index has been set up in the Bureau's Interior Offices to provide up-to-date records of lease acreages held or controlled by individuals and companies. The records are kept on a State-by-State basis.

Regulations

New regulations adopted during the past year greatly simplify the leasing of mineral deposits in unsurveyed public lands.

The changes in the mineral leasing regulations will have the effect of spreading the rectangular public land survey system over millions of unsurveyed acres.

The changes in the regulations, signed by Secretary Seaton on May 16, apply to all unsurveyed public lands and are of particular importance in Alaska. The new regulations mean that future oil and gas leases must cover rectangular areas, oriented to the cardinal points of the compass, which can easily be made to conform with the regular pattern of township, sections, and subdivision lines. An exception is made where the boundaries of unsurveyed lands maintain an irregular form.

To facilitate mineral leasing the Bureau of Land Management uses a system of protracted surveys—lines drawn on maps that follow the public land survey system, even though the boundaries have not yet been laid out on the ground. Under the amended regulations lease offers in those areas where there are approved protracted surveys must use the land descriptions of the protracted survey. By using protracted surveys the BLM is replacing the more intricate language of metes and bounds land descriptions with the official language of the public land survey system in many surveyed areas.

Other proposed changes in the Federal oil and gas leasing regulations would assure all interested parties an equal opportunity to file applications for lands formerly under lease.

The new system would call for a period each month during which the previous month's canceled, relinquished, or terminated leases would be noted on the official records. Following this period interested parties would have opportunity to file lease applications for the lands involved and all applications would be treated as simultaneously filed.

The new system would also eliminate even the remote possibility of information about lands open to new oil and gas leases being un-regularly obtained or used. The present system has placed a premium on making rapid searches of the records each morning so as to find lands available for leasing. The new proposed system would put everyone on an equal footing and would save much wear and tear on the records.

Legislation

Legislation to prevent the subdividing by assignment of Federal oil and gas leaseholds into leases covering less than 640 acres has been sponsored by the Department.

The proposed law would protect unwary investors against misleading advertising promotions which imply that many average citizens can "strike it rich" by speculating in a subdivided lease covering a small holding, usually 40 acres. Last April the Secretary publicly warned investors to be cautious over advertisements soliciting investments in oil and gas leases on Federal lands.

In past years many advertisements in newspapers and periodicals throughout the Nation have offered for sale to the public 40-acre oil and gas leases issued by the Government. The usual price of such a lease is \$100. These advertisements have often implied that many people can be lucky enough to "strike it rich", relying solely on the information offered.

Such advertisements have caused an unprecedented, tremendous influx of oil and gas lease assignments for 40-acre tracts and imposed a heavy burden on the various Land Offices. In 1952 steps were taken to restrict issuance of oil and gas leases of less than 640 acres. But advertisers were still permitted to subdivide their larger leases and assign or sublease 40-acre tracts.

The act of August 21, 1958 (Public Law 698, 72 Stat. 688), increased the maximum acreage of lands which may be held under oil leases or permits within any one State (exclusive of Alaska) from 5,120 acres to 10,240 acres. Leases or permits for up to 5,120 acres in addition to the 10,240 acres may be authorized by the Secretary of the Interior. Additional acreage would be permitted only after a public hearing. The exception would have to be to the public

interest and the additional acreage must be needed by the applicant to carry on business economically.

Other Mineral Activities

Under Public Law 167—the Multiple Surface Use Act—the Federal Government has the right to manage the surface resources (including timber and forage) on all unpatented mining claims staked after July 23, 1955. For all claims staked before that date the Government may gain the right to manage the surface resources under a legal procedure provided for in the law.

The law was passed as a conservation measure to prevent mining claims from being staked or used for non-mining purposes and to prevent timber waste. Before the law was passed, neither the Government nor a miner could legally harvest the timber on an unpatented mining claim.

The legal actions spelled out by the law require BLM to examine areas to see if there are any unpatented mining claims. Following examination, a notice is published stating that a determination of surface rights on mining claims will be made. A miner may ignore the notice (in which case he loses no rights whatsoever, while the Government acquires the right to manage the surface resources) or he may file a so-called verified statement.

If he files a verified statement, BLM then determines whether the specific claim is valid under Public Law 167. If it is valid the Government will not gain the right to manage the surface. If not valid, the Government obtains surface rights. Public Law 167 proceedings, however, are not used to determine the validity of a mining claim for patent purposes. Under Public Law 167 proceedings no miner loses any possessory rights or his rights to mine or to use as much of the surface as is necessary in his operations.

By the end of the fiscal year the Bureau completed preliminary examinations on 4,663,799 acres, with 4,508,856 acres having been included in published notices. This resulted in 451 verified statements being filed for 2,369 mining claims. Over half, or 1,250 claims have been examined as the result of filing verified statements.

On nearly 90 percent of the acreage under preliminary investigation, or 4,126,573 acres, determinations of surface rights have been completed. Of the total number of claims examined, the Government did not acquire surface resource management rights on 1,119 claims.

In addition to a full-scale program on public domain lands, the Bureau has also made publication or received requests for publication on behalf of the Forest Service, U.S. Department of Agriculture.

re, for 52,913,337 acres, and have processed verified statements involving 12,471 mining claims. Closing decisions have been issued, completing the determination of 12,333,172 acres, on which surface rights were not acquired by the Government on 197 claims.

Under the General Mining Laws, the Bureau of Land Management closed 1,052 cases involving title transfers. New and reactivated cases totalled 1,356. Approximately 15,014 acres were included in 110 patents issued during the fiscal year.

Public Land Surveys

In route by air on a trip from the eastern seaboard to the west coast, countless travelers have marveled at the wonderful symmetry of the farms and communities below. Stretched out below, as if part of a giant quilt, lie the squares and rectangles which molded the patterns of settlement and the development of the public domain.

Those squares and rectangles are made by the boundaries of townships, sections, and "40's" laid out by public land surveyors. These surveys are called cadastral surveys and they are one of the important jobs done by the Department of the Interior's Bureau of Land Management.

The public land surveys mark out boundaries on the ground and permanently record the survey data in the official field notes and survey maps (called plats).

About 74 percent of the total area of the original public domain has been surveyed. As of June 30, 1959, 475,426,559 acres remain unsurveyed, of which more than 76 percent is in Alaska.

The remaining unsurveyed land lies exclusively in the Western States, the largest unsurveyed area being in Arizona where approximately 32 percent of the State is unsurveyed. The unsurveyed area in Arizona represents about 20 percent of the total unsurveyed area outside Alaska.

Many of the markers set down by surveyors years ago have since disappeared or been destroyed. Some very early survey markers were made of wood. Other survey monuments have been buried in the rubble of development. Many of these lost or obliterated markers need to be replaced, and part of BLM's survey program is devoted to resurveying and redefining the boundaries of the public lands.

The 1959 program in the Western States has been directed particularly to areas involved in school land grants, to providing homesteads for an expanding population, and to lands for timber management. It also was geared to the settlement of trespass cases.



Surveyed boundary is cut through forest, requiring skill with axe as well as transit. The transitman is barely visible in the center of the picture.

of boundaries of Federal range lands, and development of mineral resources.

During fiscal year 1959, surveys covering 1,157,871 acres were officially accepted. More than 75 percent of this land was involved in resurveys. In addition, surveys of 1,937,460 acres were completed in the field during the fiscal year. Numerous other surveys which are not measurable on an area basis were also completed in the year during the same period.

During the year, the Bureau of Land Management spent \$2,498,400 making cadastral surveys. Approximately 85 percent of this amount came from funds appropriated to the Bureau by Congress. The Bureau was reimbursed \$242,116.61 for costs of cadastral surveys for other Federal agencies. Private contributions for carrying on the cadastral survey program amounted to \$13,329.81.

Alaska Surveys

In order to carry out the provisions of the Alaska Statehood Act which provides for the survey of the boundaries of land grant areas selected, the survey program has been greatly accelerated. The organization plan has been set up for a large program in 1960, personnel have been recruited and trained, and needed equipment has been purchased.

To facilitate mineral leasing the Bureau has adopted a system "protracted surveys"—lines drawn on maps that follow the public land survey system, even though the boundaries have not yet been laid out on the ground. By using protracted surveys BLM is placing the more intricate language of metes and bounds land descriptions with the official language of the public land survey system in many unsurveyed areas.

Protractions will be used for locating oil and gas leases and provide a means for graphically recording transactions dealing with public lands.

In Alaska it is anticipated that protractions will help the new State in its selections and will simplify survey of the exterior boundaries of selected areas. Protractions will not take the place of the final official survey but they will provide a present basis for many types of administrative actions in leasing and describing lands in which oil surveys can be made. The survey and monumentation of township boundaries and section lines is necessary for the issuance of a patent.

Particular emphasis has been placed on the need of preparing protraction diagrams for Alaska where the rectangular system has been extended over less than one percent of the State. Approximately 30 million acres of unsurveyed land in Alaska were covered by protraction diagrams during 1959.

Practical uses of photogrammetry have been developed in making astral surveys. Aerial photographs are now being used in the official method of locating water boundaries.

A project to test the application of photogrammetry on original surveys has been initiated in Alaska. A test of that procedure has been completed in Utah but the results are not conclusive as to the practicability of using the method for complete surveys. The results of the Alaska test should further determine the usefulness of photogrammetry.

Outer Continental Shelf

Work has been continued in the mapping of the coastal zone in preparation of leasing maps as the basis for the administration of

lands on the Outer Continental Shelf. These maps locate tracts the seabed for leasing oil and gas resources. During the year maps were prepared covering about 450,000 acres off the Florida Keys

Forestry

Providing management and administration for 161 million acres of forest and woodland, about one-third of which has present or future commercial value, is an important function of the Department's Bureau of Land Management.

Timber is a resource which, if wisely used, can make a perpetual contribution to the Nation's continuing growth and development. Forest management under the principles of sustained yield points the way toward continuing growth. The volume of timber that can be put on the market annually under sustained yield (called the allowable cut) can be much greater when management practices are intensified.

BLM recognizes that the needs of a growing population have created the necessity for more intensive management of the forest resources. The Bureau is going ahead as rapidly as circumstances permit, to apply all those practices which will help develop the timber growing potential of its forest lands.

From lands which the Bureau manages came enough sawtimber for lumber and plywood to build nearly 100,000 average houses.

Also harvested were some 222,630 posts and 158,763 poles, for fences and telephone lines. In addition a host of other forest products flowed out of the woods and into America's industries and homes, including tens of thousands of Christmas trees.

Scope of the Forestry Program

Harvesting mature timber at the proper time and at a rate nearly equal to the annual growth as possible is a major part of the Bureau's forest management plans. The timber is sold to the highest qualified bidder at public auction. Logging is done according to supervised plans.

The value of timber sold from Bureau lands during fiscal year 1959 was \$32,399,360 and the volume totaled 1,082,001,600 board feet—a new record. This is an increase of \$7,742,147 and 167 million board feet over the previous year.

Timber from the Oregon & California Railroad and Coos Bay Wagon Road grant lands in western Oregon accounted for 901,861,500 board feet of the total sold and \$29,421,660 of the total

due. These O&C lands are some of the most valuable and productive forest lands in the world.

Sales of timber and other forest products from the public domain lands accounted for 180,140,100 board feet and income totaling \$977,700. During 1959 less than 10 million board feet was harvested from the estimated 40 million acres of commercial forest lands administered by the BLM in Alaska. Because of the lack of demand for forest products in Alaska, only a minor percentage of the allowable cut is harvested each year. On the remaining public domain lands in the 11 western States, the annual cut is approaching the allowable sustained yield harvest.

During 1959 Bureau appropriations for forestry amounted to \$493,000.

Sales to Small Businesses

As a result of a 1958 amendment to the Small Business Act, the Department entered into a memorandum of understanding with the Small Business Administration in March 1959, regarding timber sales to small firms. As defined by the Small Business Administration, a small business is one employing less than 100 people. This definition would include the majority of companies with which BLM deals.

Each timber sale on the O&C lands averages approximately 2 million board feet. During the 3 years preceding calendar year 1959, small businesses purchased 39, 55, and 60 percent, respectively, of the volume offered. Regulations were proposed to provide sales exclusively for bidding by small business concerns.

Forest Land Rehabilitation

Increased forest land production is necessary to provide the forest products of a Nation whose population will probably top 300 million by the year 2000. In 1957 the Bureau began a greatly accelerated forest land rehabilitation program on the western Oregon forest lands.

More than 300,000 acres of these highly productive lands had not been reforested naturally since the initiation of intensive management practices in 1937. A comprehensive reforestation inventory in 1957 showed that more than 150,000 acres needed artificial reforestation. These lands have suffered repeated fires. Some of the lands did not restock naturally because of inadequate seed source, competing vegetation, rodents and bad weather.

Before 1940 the value of a thousand board feet of Douglas fir timber on the stump was approximately \$2. Today, values average \$30 or more for a thousand board feet of standing timber, with occasional prices of \$50. Declining sources of high-quality, old-growth, privately-owned timber will continue to place greater demands on Government timber. This will doubtlessly result in a long-term trend of increasing values for federally owned timber. To meet this demand, it is essential that full forest productivity be maintained at the earliest practicable time.

The accelerated reforestation program will place cutover and burned lands in production 5 to 20 years sooner than natural processes. Reforestation helps raise the allowable cut.

Results of the accelerated forest land rehabilitation program to date have been substantial. In 1959, 33,000 acres were reforested: 22,000 acres by planting seedlings and 11,000 acres by direct seeding. Site improvement was carried out on 1,300 acres and rodent control conducted on 525 acres.

The Bureau of Land Management plans to have all of the O&C lands in production. So far some 60,000 acres have been planted.

BLM has also undertaken a program to reforest selected blocks of potentially productive public domain forest lands.

Forest Inventory

Much as a grocer or merchant must make a regular stocktaking or inventory so, too, must the forest manager conduct forest inventories to determine whether stock is at the necessary level.

The volume, quality and condition of standing timber in each class must be determined. Annual growth rate must be measured. Stands of overmature, high-risk timber, and those stands damaged by fire, insects and disease must be scheduled for harvesting as early as possible to avoid loss of marketable timber.

During the past year BLM completed the first comprehensive forest inventory of the 2 million acres of O&C forest lands in western Oregon. These lands now have the most up-to-date and intensive inventory of any comparable lands in Federal ownership.

The inventory process is a continuous one, with permanent plots and basic data from those plots recorded on punched cards. Plots will be reexamined at regular intervals in a continuous reinventory. Progress of sustained yield management will be gaged by results. Future determination of the allowable sustained yield cut will be guided accordingly.

The inventory was completed one year ahead of schedule by the accelerated efforts of Bureau forestry personnel. The informatio

obtained has made possible an increase of 104.9 million board feet in the annual allowable cut from the O&C lands. The total has been raised from 769.3 million board feet to 874.2 million board feet, including an additional 125.8 million board feet of salvage timber, approximately 1 billion board feet is scheduled to be offered for sale from the O&C lands in 1960.

The economy of the western Oregon communities depends heavily on the production, manufacture and merchandising of lumber and forest products. Plans to increase the Bureau's timber sales program for 1960 will provide an estimated 2,000 additional man-years of employment in western Oregon. As population continues to grow in that area, BLM sales will help the forest industries provide more jobs.

The Bureau is making continued progress in a comprehensive inventory program for public domain forest lands in 11 Western States where BLM has the responsibility for management of 3.8 billion acres of commercial timberland. Local communities are not often economically dependent on intensive development of scattered public domain lands. Yet the harvesting and merchandising of timber from these lands is an important contribution to the local economies. Information now on hand demonstrates that timber sales from these lands can be substantially increased in the future.

The nationwide forest resources survey has been extended to the new State of Alaska. These current inventory studies are the most comprehensive ever undertaken and will evaluate for the first time the true potential of Alaska's forest resources. At the present time a very small percentage of the annual forest production of Alaska is harvested.

Access for Management and Development

BLM forest management plans give high priority to the development of a network of forest access roads.

It is the policy of the Bureau to guarantee equal access to everyone qualified to bid on timber sales. The O&C lands are a checkerboard of intermingled ownerships. To assure access, BLM has a positive program to acquire hauling rights on privately owned lands and the right to build new roads when necessary.

Access is frequently obtained by negotiated reciprocal right-of-way agreements. Rights-of-way and road easements are also purchased. When satisfactory access to Bureau lands and timber cannot be obtained in any other way, the Government must exercise the right of eminent domain.

In the past 10 years the Bureau of Land Management has signed 471 road agreements with owners of intermingled land and 711 right-of-way and road easements.

Roads are built either under the terms of timber sale contracts by regular appropriations. In either case the Government owns the roads.

When roads are constructed under terms of timber sale contracts the Bureau requires the successful bidder to build roads. Allowances are made in the timber appraisals for road construction. In this way the timber pays for the roads.

In areas of rugged terrain containing large stands of old-growth timber ready for harvest, and where the cost of constructing mainline forest access roads would be too high to handle through small timber sales, construction is financed by funds appropriated by the Congress. These access road funds are a long-term capital investment in intensive management.

Under an agreement with the Federal Government, the 18 western Oregon forest land counties are making available for road building and reforestation, about one-third of the 75 percent share of receipts to which they are entitled. The counties' contribution toward the 1959 access road construction program amounted to \$5,185,000. This is an outstanding example of Federal-State cooperative program in action.

A total of 268.4 miles of mainline access roads and 38 bridges have now been completed, or are under construction.

Vigorous implementation of the Bureau's access road policy will continue to be a keystone in the management policy of the Bureau in the years ahead.

Range Management

Just two days before the close of fiscal year 1959 BLM marked its 25th anniversary of the Taylor Grazing Act. Passed in 1934, the Taylor Grazing Act is the source of BLM's important range management and conservation programs extending over more than 179,700,000 acres of Federal lands in 11 western States. Under another act the Bureau also handles grazing and range management on some 11½ million acres in the State of Alaska.

In the first quarter-century of applied conservation on the Federal range, great strides have been made in building and rebuilding the productivity of the lands. In each of 59 organized grazing districts BLM managers and technicians are welding together conservation

programs for soil, water, minerals, forage, forests, wildlife, and livestock.

Last year more than 10 million head of cattle, sheep and horses grazed on Federal range lands. Livestock use was divided among 15,769 ranch or farm operators who held 18,185 permits for the use of grazing district lands and 10,342 leases covering 17,331,238 acres outside grazing districts. The lands outside grazing districts are called "section 15 lands," after the part of the Taylor Grazing Act under which they are managed.

In addition, more than 1,250,000 big game animals obtained part of their annual food requirements from grazing district lands and accounted thousands roamed other BLM lands.

During the past year, the Bureau has concentrated on managing the forage resources to insure their continued and growing productivity. Total Bureau of Land Management appropriations for range management included \$2,601,700 for grazing administration; \$828,200 for soil and moisture conservation; \$1,079,000 for weed control, and \$686,713 for range improvements.

General Range Conditions

Range conditions in the Federal range States varied widely during the year due to erratic patterns of rain and snow. In California drouth has been acute. Use of the winter ranges was severely limited because of lack of stock water and actual use was probably less than licensed use. In Nevada, after experiencing very good range conditions during the spring and summer of 1958, precipitation was several inches below normal.

There are indications that Utah and the western slope of Colorado are again threatened with drouth conditions. Wyoming, Montana, and New Mexico ranges are in generally good condition, although some areas are below normal in southern Montana.

Idaho received normal precipitation during the spring of 1958 with above-normal forage production. In Arizona calf weights last year were the heaviest on record. In Oregon the grazing season closed with above-average growing conditions. All Oregon ranges suffered from the lack of runoff to provide stock water, resulting in a concentration of stock around perennial waters.

Many ranges had a heavy carryover of old forage, and most livestock entered spring ranges in fair to good condition. There has been a continuing shift in livestock using the Federal range from sheep to cattle.



Fighting range fires and forest fires is tough, dirty work. Fires often start in areas many miles from water. Many fires are fought without water as men throw shovelfuls of dirt to beat down the flames and rob the fire of air. Last year was a critical range fire season.

Grazing Administration

An important addition was made to the Federal range on November 6, 1958, when President Eisenhower approved the transfer of approximately 2¼ million acres of Bankhead-Jones Farm Tenant Act lands from the Department of Agriculture to the Department of the Interior. These are so-called LU (Land Utilization project) lands.

Approximately 1,935,000 acres in Montana and 234,000 acres in New Mexico were transferred for management by the Bureau of Land Management under the Taylor Grazing Act. The transfer included management personnel and property. The Bureau is completing formal orders which will include these lands in four grazing districts in Montana and two in New Mexico.

Executive Order 10787 transferring these lands also covers about 11,000 acres in Texas and California which were transferred to the jurisdiction of the Bureau of Sport Fisheries and Wildlife of the Department of the Interior's U.S. Fish and Wildlife Service. About

5,000 acres in Montana were also transferred to that agency. About 400 acres within the exterior boundaries of the Fort Peck Game Range were transferred for joint administration by the Bureau of Land Management and the Bureau of Sport Fisheries and Wildlife.

Building Range Productivity

Approximately two-thirds of the Federal range in 10 western States have been covered by comprehensive field studies and surveys to determine range condition. One of the most important accomplishments in the administration and management of grazing districts in the 25 years they have been under Bureau administration is the halting of downward trends in range conditions. This was done while the ranges were receiving continued grazing use.

The tabulation below clearly shows the progress that has been made in 25 years. It also indicates the job remaining to be done.

What is happening on the range?

| The trend from 1930 to 1935 | | | The trend from 1954 to 1958 | | |
|-----------------------------|--------------------------|---------|-----------------------------|--------------------------|---------|
| Trend | Acres | Percent | Trend | Acres | Percent |
| Improving..... | 1,255,000 | 1 | Improving..... | 36,907,417 | 25 |
| Little or no change..... | 7,864,000 | 6 | Little or no change..... | 85,077,297 | 56 |
| Declining..... | 118,673,000 | 93 | Declining..... | 27,983,308 | 19 |
| Total..... | ¹ 127,792,000 | 100 | Total..... | ² 150,668,022 | 100 |

¹ Does not include approximately 23 million acres in reservations.

² Does not include 6,730,000 acres of waste or unusable range.

Source: Data for 1930-35 from *The Western Range*, Senate Document No. 199, 74th Congress, 2d sess., Washington, D.C., U.S. Government Printing Office), p. 116. Data for 1954-58 from BLM reports.

The Bureau continued to assign first priority to adjusting livestock use on those areas of Federal range showing the most severe range. Increased emphasis was placed on the adjudication program and the establishment of individual grazing allotments. Considerable effort was made to obtain reliable forage inventory data in areas where range adjudication was undertaken. Management plans were developed unit by unit as range adjustments were made, considering the needs of forage for wildlife in each of the units adjudicated.

Once the stocking rates are brought into balance with grazing capacity, later increases in the forage supply may be followed by an increase in livestock numbers. Range development programs are being initiated to improve productive capacity and bring back lost grazing capacity.

In connection with the adjudication program a new policy governing the conduct of resource surveys was issued.

the year. The new statements covers planning, conduct, and of original surveys, resurveys, and rechecks of old surveys. In addition, the Bureau has made firm plans for cooperation with State and Federal land managing research agencies to improve the accuracy and reliability of range survey methods.

Progress has been made in programs designed to improve the pattern of land ownership within grazing districts.

As further components of grazing administration, range inventories and dependent property surveys continued to be important activities during the fiscal year.

The problem of managing ranges now dominated by cheatgrass has resulted in a Bureau request for a systematic study of cheatgrass ranges by the Intermountain Forest and Range Experiment Station of the U.S. Department of Agriculture. More than 2 years of observational research has demonstrated the need for a series of experimental pastures to obtain answers to many questions about the management of cheatgrass ranges. The study will benefit both users of cheatgrass ranges and public land management agencies.

Range Conservation and Improvement

Top priority for range conservation treatment is given to depleted areas where steps have been taken to balance licensed use with available forage. Conservation plans on a watershed basis integrated with range management and other resource management programs. Practices carried out under the soil and moisture, weed control, and range improvement programs contributed to soil stabilization, water conservation and other aspects of watershed management.

Prominent land treatment practices applied include range seeding and brush control to increase the quality of desirable vegetation. Range seeding projects totalled 111,936 acres. Increased attention was given to the use of the anchor chain drag, rotary brush cutter and to chemical treatment as a means of eradicating undesirable brush stands. Improved techniques in the use of such methods resulted in decreased costs and greater protection to the soil surface from wind and water erosion.

During the year, 52 detention dams, 41 diversions, and 2,284,800 linear feet of dikes and 350 reservoirs were constructed.

A major accomplishment during the year was the reevaluation and revision of the long-range conservation needs by major river subbasins. Experience gained since the beginning of the Department's soil and moisture conservation program has provided much

liable estimates of needs on the 42 major subbasins involving Bureau lands in 11 western States.

Permittee participation and interest in the range conservation and improvement program has increased materially. Last year range users contributed \$302,318 to the soil and moisture program. This amounted to an increase of \$64,573 over the 1958 total. The large number of BLM conservation practices that are being duplicated on nearby private range lands is further evidence of the interest in and success of the program.

Close cooperation was maintained with land grant colleges and Federal research agencies to develop improved conservation techniques and to determine the effects of conservation practices on erosion control, sedimentation, and downstream water yields. An intensive range improvement and rehabilitation program was begun in cooperation with the Navy Department on the Naval oil shale lands in Colorado.

The range improvement program to build fences, develop stock water, construct truck trails and roads, and other needed facilities improved range management was tied in more closely with specific grazing administration activities during the year. Priority is given to maintaining existing range facilities. Range users undertook a big part of this maintenance, permitting new construction by the Bureau. Improvements completed during the year included 709 miles of fencing, 48 wells, 76 spring developments, 136 miles of truck trails, and 144 cattleguards.

In addition, privately contributed funds permitted the construction of conservation and improvement projects involving 274 reservoirs, 521 miles of fencing, and 31 corrals. This work is done under authority of sections 4 and 15 of the Taylor Grazing Act.

The Bureau's fencing operations are part of the range management program. In fencing public range lands, the influence of fences on big game herds is taken fully into account. As the result of a study of fencing and antelope migrations, the Bureau has adopted fence standards which will minimize the effects of fencing on game movements.

Weed Control

The weed control program reduces the destructive influence of noxious weeds on BLM lands and prevents or reduces their spread. Sagebrush, a poisonous plant, kills several hundred sheep and cattle every year. About 11 million acres of range land in the western States, including 8 million acres of BLM lands, are infested with the noxious weed.

It is now a firmly established fact that halogeton is seldom a problem on range lands with adequate good forage plants and grasses whose vigor can crowd it out. Livestock will seldom crowd out halogeton when other forage is available.

A natural avenue of attack on this weed is to crowd out halogeton with more vigorous livestock forage. Last year, more than 25,000 acres of halogeton-infested lands were seeded to perennial grass. A chemical herbicide (2,4-D) was used on another 11,000 acres. Chemical control is now mainly used to treat isolated patches and to reduce the rate of spread from areas of heavy infestation.

Measures to improve the general condition of the range, such as waterspreading, contour furrowing and soil pitting are also used effectively against halogeton. Fencing to improve livestock grazing patterns and reduce over-use, along with other improved livestock management practices help to speed range recovery and reduce the check halogeton's spread.

Over 10 million acres of infested and threatened lands need further improvement to restore their productivity.

Over 57,000 acres in southern Idaho infested with annual weeds and plants of the beet leafhopper were seeded to perennial grasses and fenced during 1959. This was an initial effort to control this serious insect pest and reduce agricultural crop losses from curly leaf disease.

Control of Medusa-head rye, an annual grass of low forage value and extreme competitive ability, as well as other troublesome weeds infesting various portions of the Federal range has been confined to a relatively limited acreage. Medusa-head rye has invaded over 700,000 acres of range land in Idaho and many thousands of acres in southern Oregon and northern California. Efforts to control these plants warrant expansion in the future.

Section 15 Lease Administration

Grazing lease rental rates were raised on section 15 lands to be consistent with the present section 3 grazing fee of 22 cents per cow month. Yearly lease rentals had varied from \$0.001 to \$0.01 per acre. The new schedule, which became effective April 20, 1959, established lease rentals at \$0.049 to \$0.880 per acre.

Wildlife and Recreation

The Bureau's fencing policy has been spelled out as it relates to the wildlife resource. It includes development of a model cooperative agreement for range development and improvement.

work. Fencing of areas important to wildlife will only be done with proper safeguards for wildlife.

Public recognition of the role public lands play as a major recreational resource has spotlighted the need for improved access routes to Federal lands for hunting, fishing, and similar activities. BLM will meet the problem by developing entrance routes under cooperative agreements with landowners, sportsmen's groups, and others. Efforts will be made to improve the land pattern by change-of-use agreements, reciprocal use agreements, or exchange of land title to connect links between isolated areas. When it is not possible to work out cooperative access programs, BLM may then use whatever legal means are available and appropriate. If there is a large body of public land involved, and the access situation warrants, BLM may use legal means to acquire a suitable access route.

Alaska Grazing Resources

There is increasing interest in Alaska's grazing resource. As yet, however, detailed information about Alaska's grazing resources is extremely limited. During fiscal year 1959 there were 61 grazing leases in effect covering 1,510,107 acres.

Fire Protection and Control

No enemy of conservation rivals the destructive power of fire. Every year millions of dollars worth of valuable natural resources are lost up in smoke—forest, grassland, tundra, and desert forages. In addition to immeasurable losses of harvestable resources, fires destroy the shelter and food for wildlife, and leave ugly, naked land to the mercy of rain and wind erosion.

Fire protection and control on lands cared for by the Department of the Interior's Bureau of Land Management is a job of enormous dimensions. It involves fire protection and fire suppression on a total of some 386 million acres, of which about 225 million are in Alaska and 161 in 12 other States.

During calendar year 1958 BLM fire suppression crews went into action on 1,359 fires and held the burned area to 933,796 acres. In 1957 1,230 fires had burned 5,531,807 acres. Of the 1958 total, 686 of the fires burned 676,253 acres on BLM lands. The 686 fires swept over 257,543 acres of adjacent private lands and were put out by the Bureau to protect nearby BLM lands. In California, Oregon, Washington, Idaho, Montana, New Mexico,

and Minnesota the Bureau handles part of the fire control job through protection contracts. These contracts are made with other Federal, State, or local agencies. On lands under contract protection 299 fires burned over 11,771 acres. The total cost of contract fire protection during fiscal year 1959 was \$1,005,000 for the safeguarding of some 5,736,300 acres.

Smokejumpers

During the past year the Bureau has given top priority to the development of a smokejumper installation in Fairbanks, Alaska. This involved constructing the necessary headquarters facilities, parachute loft, and the modification of a cargo plane to permit safe exit on fire jumps.

By the end of the fiscal year 15 seasoned smokejumpers are helping to solve one of the most difficult problems facing fire control efforts in Alaska—getting to fires while they are still small. These smokejumpers, for whom the glamour of parachuting onto forest fires soon turns to seemingly endless hours of smoke and fatigue, make it possible to put skilled teams on many fires in the remote interior of Alaska which in the past would have burned uncontrolled until stopped by nature.

By the last day of the fiscal year, BLM's 15 smokejumpers, who had been on duty less than a month, had already made 109 jumps on 25 fires. They had completely put out 11 fires, including one that had spread to 30 acres. But the blowup conditions which Alaska fire control men faced could hardly have been encouraging. On that same day there were over 70 fires burning. BLM had 538 emergency fire fighters and 31 permanent BLM personnel on 23 of these. Forty-seven fires were as yet unmanned and uncontrolled.

BLM has greatly expanded the use of borate drops to put out fires or hold the lines until ground forces arrive. During the 1958 fire season 240 tons of borate (a chemical that is mixed with water to form a slurry that is spread from airplane tanks) were dropped on fires in Alaska. In the early weeks of the 1959 season Alaska fire fighters had already dropped 172 tons during 127 sorties. Twenty-seven fires had been completely controlled by borate alone. Other drops had greatly helped the ground crews in their struggles to control the fires. Borate has also been used in large quantities on western range fires.

BLM's increased efforts to control Alaska fires are hampered by the size of the State and the geographic facts-of-life. Distances are long, summers are very dry, and dry lightning storms are common.



owing smoke marks an Alaska forest fire. Two smokejumpers will be on the job. The canopy of each jumper's parachute is visible above and to the left of the fire's base.

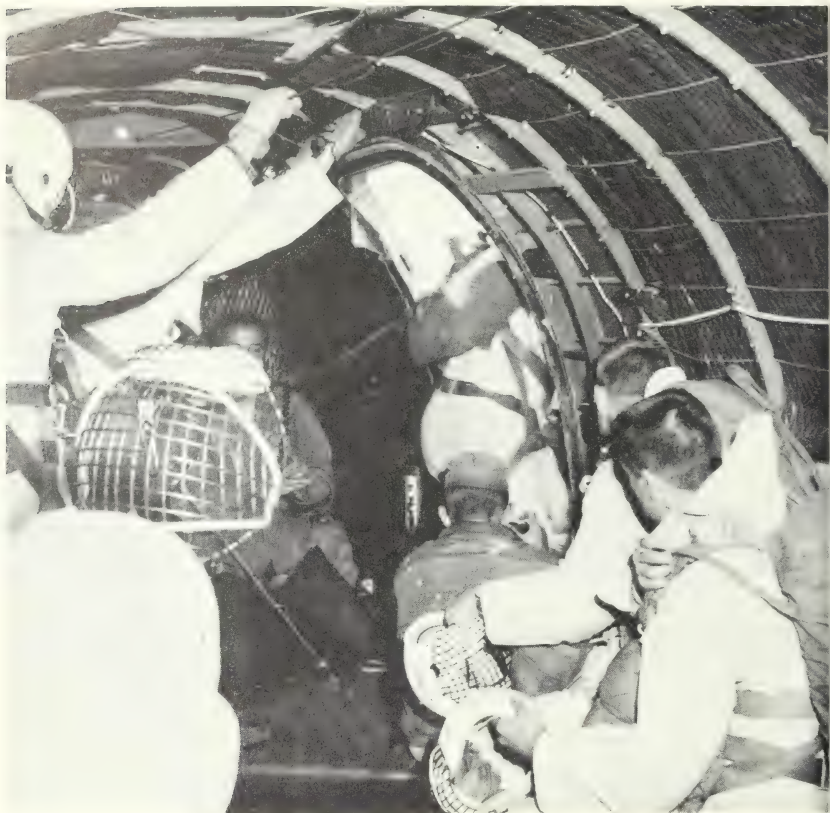
ing the summer months. Even with the help of smokejumpers, rate dropping planes, and the most modern equipment available, severe fire season and large burns are still possible.

ire conditions on western range lands have been severe. Heavy months of fast-burning fuels and an increased number of lightning storms teamed up to produce the conditions that could have led to a disastrous fire year. In spite of these conditions BLM held the burned area to 617,000 acres.

ire weather stations installed last year have furnished data for the new fire danger rating system. As a result the Bureau was better prepared to meet fire conditions as they arose, and standby crews are ready to move in swiftly as soon as a fire is reported.

Other special projects to improve fire control on western range lands included the installation of additional radio equipment, the use of borate drops and greater use of helicopters to transport crews to and from fires.

Fire control involves two appropriations. One is for presupplies and operations. This must take care of all the costs necessary to



Geronimo! Alaska smokejumpers help BLM get to fires sooner and control them while they are small. The helmets and wire face masks protect the men from limbs and branches.

acquire and maintain BLM's fire fighting equipment, supplies, buildings, aircraft, and so forth. It pays for training crews and pays their salaries while they are not actually at fires. It also pays for all of the fire protection contracts. The other fire appropriation covers the actual cost of fire suppression.

The BLM appropriation for presuppression during fiscal year 1959 was \$890,100 of which \$625,000 covered presuppression activities in Alaska. Fire suppression costs during fiscal year 1959 totaled \$2,989,718, of which \$1,457,032 was spent fighting fires in Alaska. The total amount spent for fire protection is, of course, only a small fraction of the value of the resources involved.

Eastern States

The remaining scattered areas of public domain lands in Alabama, Kansas, Florida, Louisiana, Mississippi, Michigan, Wisconsin, and Minnesota are administered by the BLM's Eastern States Office. Under the program of the Eastern States Office the area of public domain lands in the East is rapidly diminishing, as lands are transferred out of Federal ownership to States, local governments, organizations, and individuals.

In 1959 the Eastern States Office transferred title to 19,840 acres of public domain lands to non-Federal ownership; 13,104 acres were sold at public auction; and 4,248 acres transferred to individuals under the Color-of-Title Act. A total of 808 acres was transferred to States and local municipalities under the Recreation and Public Purposes Act in addition to 1,680 acres under state grants and homestead selections. Receipts from sales amounted to \$414,172.

Noncompetitive mineral leases and permits on both public lands in the above States and on acquired lands in the 18 non-public States, where the Eastern States Office has responsibility for surface resources, accounted for \$656,436 during the fiscal year ended June 30, 1959. Total amount received from mineral leasing (including competitive leasing) during this period was \$3,213,258. As a means of increasing and consolidating services to the public the Russellville, Ark., office was closed May 1 and the remaining work transferred to the New Orleans office. Because of the small amount of public lands remaining in the Gulf States, area sales were discontinued. Any lands remaining are open to individual application through the New Orleans office.

The local field office at Bemidji, Minn., was transferred on May 1 to St. Paul, Minn. The St. Paul field office provides close contact with the State Department of Conservation in working out a cooperative program for the important resources on approximately 100 acres of public lands remaining in Minnesota, much of which the State can acquire and administer.

Public lands remaining in Michigan and Wisconsin will also be open for application through the St. Paul office.

Three major accomplishments under the Recreation and Public Purposes Act during 1959 were:

Key Costa Island in Florida.—After several years of negotiation with the county, a plan of lease and purchase of the 655-acre island was worked out. Patent was issued September 3, 1958, for 100 acres and the balance leased for one year. This will be renewed year until the total acreage is purchased.

St. Francis River Floodway in Arkansas.—With the concurrence of the United States Fish and Wildlife Service of the Department of the Interior, a similar lease-sale plan was worked out with the Arkansas Game and Fish Commission. The Commission will purchase approximately 600 acres annually of some 4,000 acres in the St. Francis Floodway now withdrawn for public hunting. The first application for 639 acres has been received. No change in use is planned.

Gulf Breeze Tract in Florida.—With the help of Santa Rosa County and other interested parties, the Bureau has arranged a program for acquisition of a valuable 187-acre tract on Santa Rosa Sound across Pensacola Bay from Pensacola, Fla. Santa Rosa County agreed to apply for the entire tract with the understanding that other interested parties would be permitted to develop and use portions of the area. The area is very valuable for recreation, civic, and residential purposes. A resurvey is now being made.

Outer Continental Shelf

On May 26, 1959, the Bureau of Land Management Office in New Orleans, La., resumed an active oil and gas leasing program when some 458,000 acres of submerged lands off the southwest coast of Florida were offered for lease sale. The sale resulted in 2 leases totaling 132,480 acres with bonus bids amounting to \$1,711,800. The area was not part of the lands involved in the boundary dispute pending before the United States Supreme Court.

The office in New Orleans, administered by the Bureau's Eastern States Office, maintained 381 active OCS leases embracing 1,473,400 acres. From the leases and pipeline rights-of-way \$3,412,204 were collected in lease rentals and royalties. Fifteen applications for pipeline rights-of-way were approved during the year.

On May 1, 1959, the functions of the New Orleans office were expanded to include land applications and claims work in the southeastern public land States.

International Cooperation

Experienced technicians of the Bureau, in support of international technical assistance programs, are assisting other countries in adapting fundamental principles of land and resource management which have proven successful in the United States. These include cadastral engineering survey systems for accurate ownership boundaries.

record methods, land use classification, public hearings, adjudication of conflicting applications and claims, mineral leasing, grazing and forestry programs. Officials throughout the free world constantly observe BLM technical responsibilities, policies, legislative authority and operating methods. BLM experience on resource management is reaching most countries. During the year more than 75 officials and technicians from other countries visited Bureau offices.

Appeals

Under Departmental regulations, anyone who has been adversely affected by a decision issued by a Bureau of Land Management field office may appeal to the Director. Such appeals cover all BLM land offices and hearing examiners. The appeals are handled by a special division of the Director's Office established in April 1955.

At the beginning of the fiscal year there were 2,272 appeals pending action. A total of 4,819 were received during the year. A total of 4,600 appeals were disposed of by 1,608 separate decisions. In addition 2,590 miscellaneous letters and memoranda were prepared in connection with appeals. There were 2,491 appeals remaining on hand at the close of the fiscal year.

The number of appeals disposed of during fiscal year 1959 was more than double the 2,141 appeals acted on during the previous fiscal year. Thus almost twice as many new appeals were received and disposed of during 1959 than in the previous year.

In one area alone, appeals on 740 desert land applications, covering more than a quarter-million acres in seven southern California counties were processed by the Appeals Office.

During the year the Bureau and the Department began a comprehensive study of the appeals system and the ways in which appeals are handled and treated.

Hearings

During the year 328 proceedings were referred to Bureau Hearing examiners for formal hearings as required by law or by the regulations of the Department. Included were 93 appeals and 3 enforcement proceedings under the Federal Range Code, and 232 proceedings to determine the validity of 924 mining claims and other land entries.

Hearings were conducted in 136 lands and minerals proceedings during the year and in 60 grazing cases. Hearing Examiners closed 297 cases on their dockets, including 95 grazing cases and 202 lands and minerals proceedings involving 537 claims and entries. In 164 of the closed cases, decisions "on the merits" following hearing were rendered. The remainder were closed without formal hearing. Unclosed proceedings at the end of the year numbered 295, including 112 grazing cases and 183 lands and minerals cases.

There was increased activity under both the act of August 1954 (Public Law 585), which provides for multiple mineral development of public lands, and the act of July 23, 1955 (Public Law 167), providing for multiple use of the surface of unpatented mining claims.

During the year, Hearing Examiners received proceedings under the 1954 act involving 289 mining claims, compared with 34 claims during the previous year. Proceedings under the 1955 act referred to Examiners during the year involved 236 claims, more than twice the number in fiscal year 1958.

The Bureau prepared a compilation of decisions rendered by the Department during the period 1936-58 in cases arising under the Federal Range Code for Grazing Districts. The printed, one-volume compilation, with index-digest, will be available from the Superintendent of Documents.

Program Coordination

An increasing population places heavy demand on America's natural resource base. More timber products, more meat, more water and more land for industrial uses and recreation are needed. Providing for these needs, which are often in competition with one another, requires forethought and planning. The Bureau has, in the last 4 years, been developing and refining a system for the concise expression of these plans.

In order to receive the most benefit from both field and headquarters experience the system has been designed, reviewed and modified by committees representing all levels of all activities of the Bureau. The system therefore provides a mechanism for submitting balanced programs that reflect national needs as well as local situations.

At a third Bureau-wide program conference the system was further refined and many procedures were simplified. The system has, for the past 2 years, included a method for reporting progress

the end of each quarter. The quarterly progress reports were revised to provide a concise and complete progress report which can be rapidly summarized at all levels.

Management Improvement

One of the ways in which the Bureau tries to handle more work with increasing efficiency is by constantly improving office procedures and methods. Using all of the tools of management improvement, all offices are constantly working to do a better job in its public service functions. Central leadership and control of these efforts is furnished by the Management Improvement Office.

The number of employee suggestions received, the number and percentage approved, the benefits realized and the amounts paid in awards all showed significant increases over the past year. The number of persons receiving cash awards for sustained superior performance increased almost 20 percent. One award for distinguished service was given, meritorious awards were made to six employees and commendable service citations were made to eight persons. A Bureau candidate received a meritorious award from the William A. Jump Memorial Foundation for exemplary achievement in public administration.

The Bureau Forms Control Program continued to make progress. Forty-five members of various Bureau staffs in the headquarters office participated in a workshop on forms improvement. Similar workshops are planned in several field offices for the coming year. The Bureau has established a new management improvement project reports system. The new system creates a simplified scheduling and reporting procedure. Fifty-three new projects were started during the year, 56 completed, 3 canceled, and 40 remain in progress. Special management surveys were made in the Socorro and Farmington, N. Mex. District Offices and the Santa Fe, N. Mex. District Office. The District Office studies resulted in better understanding of grazing district operations and problems not only in these two districts but others as well.

As a result of a study of the appeals office, the organization of the office was changed to simplify lines of supervision and control in the preparation of decisions on appeals to the Director.

Records Improvement Project

The Records Improvement project is installing a modern indexing system which will show the title, use, and availability of

the public lands and resources administered by the Bureau of Land Management. The new records will replace old records that have deteriorated with age and use.

During fiscal year 1959 two records revision contracts were completed and a third contract was awarded. The pilot Utah contract was completed in 1958. A contract for revision of the Oklahoma status records was also completed on September 17, 1958. A similar contract for New Mexico was completed April 27, 1959. The total cost of the records revision programs for Oklahoma and New Mexico was \$275,986 and \$695,595 respectively.

On October 7, 1958, a contract was awarded to a Massachusetts firm for preparation of new records for the State of Arizona. At the end of the fiscal year this contract was 13 percent complete.

Personnel Management

Special attention was given during the year to the recruitment of additional employees for service in Alaska to meet the new obligations placed upon the Bureau. New employees for the accelerated survey program included cadastral surveyors, cartographers, cartographic survey aids, photogrammetric aids, draftsmen and computation aids. As of June 30, 1959, there were 67 employees in the above categories assigned to the Alaska survey program.

As of this same date, there were 2,366 permanent and 782 seasonal employees on the rolls of the entire Bureau. This total was distributed as follows: Area 1 (Washington, Oregon, California), 1,017 permanent and 210 seasonal; Area 2 (Idaho, Nevada, Utah, Arizona), 517 permanent and 282 seasonal; Area 3 (Montana, Wyoming, Colorado, New Mexico), 570 permanent and 139 seasonal; Area 4 (Alaska), 265 permanent and 122 seasonal; and Eastern States Office and Director's office (Washington, D.C.), 322 permanent and 29 seasonal.

Revisions were made in the Bureau's Promotion Plan to meet the requirements of the new Government-wide promotion plan inaugurated by the Civil Service Commission on January 1, 1959. The Bureau since 1955 has had a formalized promotion plan in operation which met most of the Commission's requirements.

Training

The Government Employees Training Act provided emphasis on training and authorized attendance of several employees in specialized sessions at non-Federal facilities when training was not available.

le within the Government. The Bureau Training Committee was expanded to provide better guidance of training activities under the act and to aid in determining policy in training and in attendance meetings.

Six employees participated in the Tenth Departmental Management Training Program. Three employees completed the Middle Management Training Program with one representing the Department as a Civil Service Commission intern. Three employees also participated in the management program conducted by Consolidated Administrative Services in Portland.

Emphasis in training continued to be in the principal functions of the Bureau but with an increase in sessions on administrative services.

Bureauwide conferences were held in forestry, range, minerals, lands, cadastral surveying, personnel, and budget and finance. Land classification and appraisal was the subject of two week-long conferences which included all lands officers and land examiners.

Safety

During the year, Safety Officer positions were set up in Areas 1, 2, 3, 4, and plans made for establishing such positions in the other areas. This was done by adding safety duties to existing positions. Emphasis was given to training the incumbents as well as members of Area and State Safety Committees.

A satisfactory decrease in accidental injuries and property loss was accomplished during the year.

Procurement and Supply

Special attention has been directed toward obtaining improved office and warehouse facilities for BLM activities to improve operations and provide better service to the public. During the year, 19 Bureau offices were moved to new space or received additional space assignments.

New or improved warehouse facilities were acquired in 11 locations. In addition, 8 small portable buildings to house radio stations in eastern Oregon, and 16 quonset huts for storage in Alaska were acquired from other agencies at no cost to the Bureau.

Continued emphasis has been placed on procurement and property management throughout the Bureau. Improvements in the field include the decentralization of these functions in Alaska, and a highly Bureauwide improvement in the form and content of reports.

tions to bid on contracts. Complete standardization of certain types of contracts and the use of standardized clauses in others has reduced the time and work involved in preparing bid invitations and significantly expedited procurement.

Excess property with an original acquisition cost of \$656,000 was acquired by the Bureau at no cost. During the year, excess property with an original cost of \$98,000 was reported to the General Services Administration. The excess property was transferred to other agencies, donated to educational or public health agencies, sold, or junked.

Finance

Total appropriations (including supplemental appropriations) for the Bureau's management operations during fiscal year 1959 amounted to \$26,910,100; for construction, \$5,685,000; and \$686,711 for range improvements.

The work of the Bureau is financed by the Management of Land and Resources appropriation and is divided into 10 functional activities representative of the Bureau's responsibilities. The suppression of fires on timber and grazing lands under the jurisdiction of the Bureau required a supplemental appropriation of \$2,500,000 in 1959.

The Bureau's program for construction encompasses the construction of access roads to timber resources principally on O. & C. lands and to a smaller extent on other lands under the Bureau's jurisdiction, as well as the building program in Alaska largely for fire protection facilities.

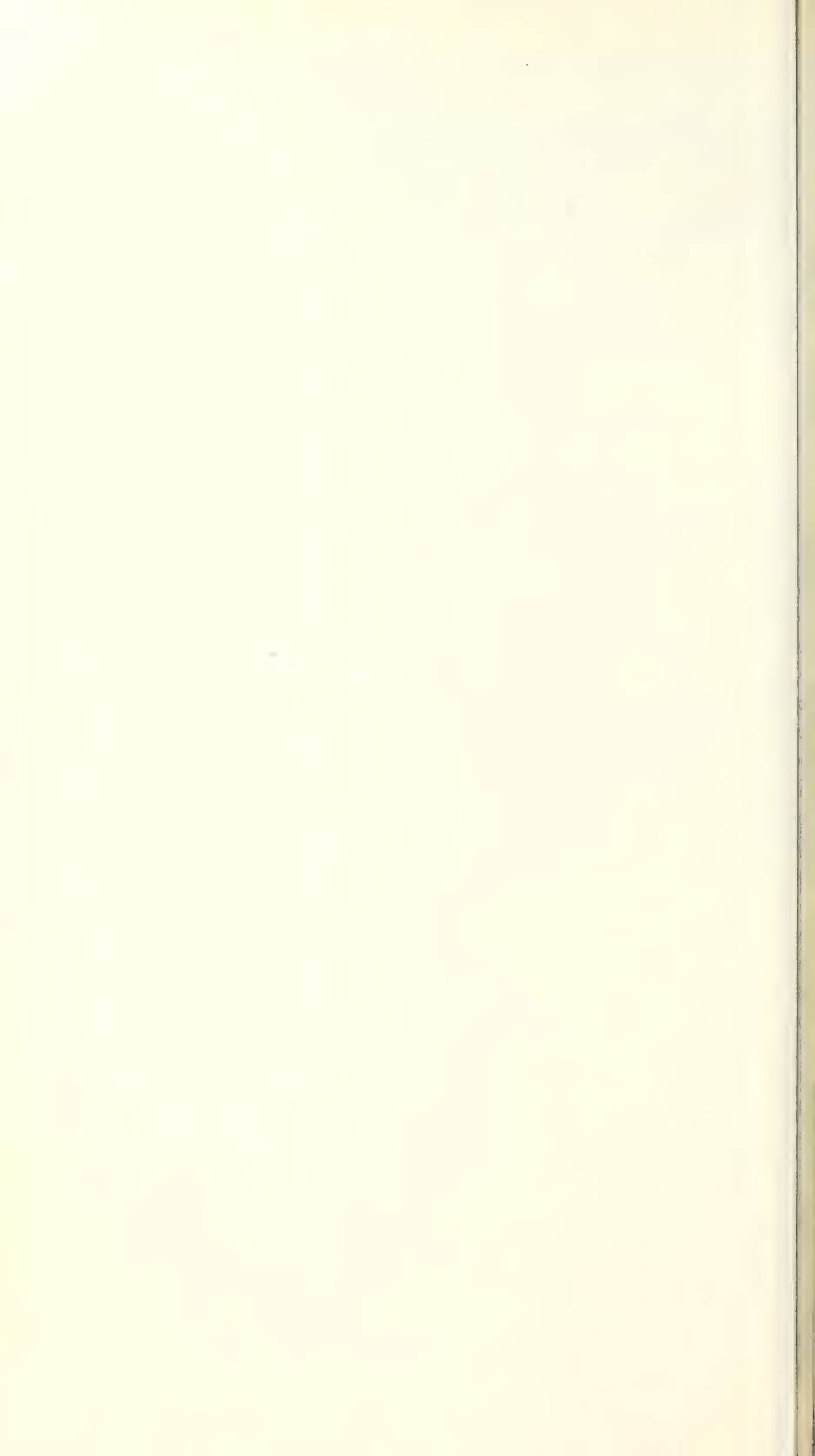
Receipts

Gross receipts from the sale and management of public lands and resources during fiscal year 1959 totaled \$136,720,871. These receipts came from the following sources: mineral leases and permits—\$9,877,122 (including \$3,412,204 from rents and royalties on the Outer Continental Shelf); timber sales—\$31,750,860; sales of public lands—\$4,239,230; grazing leases, licenses, and permits—\$3,067,261; fees and commissions—\$1,265,544; rights-of-way \$127,211; and \$393,643 from all other sources.

Bureau of Land Management receipts for fiscal year 1959 were distributed as follows: \$51,342,957 to 27 public land States (of which \$14,761,926 went to the 18 western Oregon timber land counties); \$48,782,262 was deposited to the Reclamation Fund; \$32,412,831 went into the General Fund of the Treasury; \$2,996,684 was trans-

red to other Government agencies; \$117,495 was earmarked for Indian Trust Funds; and approximately \$768,653 was returned to the grazing districts for range improvements.

BLM receipts since organization of the Bureau in 1946 have now totaled \$1,213,489,540.



National Park Service

Conrad L. Wirth, *Director*



ON JUNE 30, 1959, the Mission 66 program of the Department of the Interior's National Park Service was poised to push forward to the fourth year of its 10-year program to assure the development and protection of the National Parks, Monument and Historic Sites for the enjoyment and inspiration of future generations.

As fiscal 1959 ended, the National Park System was in the best condition in its history. Almost everywhere throughout the Department's 181 park areas, improvements promised when the program was launched in 1956 were becoming visible.

Yet, even as the new improvements came into being and as park efforts were increased, it became clear that even more strenuous efforts must be made in the coming years to keep abreast of the ever-increasing tide of visitors.

In the first 6 months of 1959 visitation to the parks was 8.5 percent above the total for the same period in 1958, and it was estimated that visitation for the 1959 calendar year would approximate 62,000,000 or 6.2 percent more visitors than were recorded in the previous year.

The challenge confronting the Service now is to push its Mission 66 program forward with all possible vigor and speed to meet the rapidly rising demands of the people for enjoyable and educational use of the National Park System.

When Mission 66 was launched on July 1, 1956, it was planned that orderly progress, year-by-year, would find the National Park System properly staffed and equipped to care for 80,000,000 visitors in 1966—the 50th anniversary of the establishment of the Service. Bold and forward looking as original Mission 66 planning was, it has already become apparent that it is insufficient to meet the expected swift increase in demands being made upon the National Park System. Already it is evident that more than 80,000,000 visitors

visit the parks in 1966 and plans must be made now to provide facilities and the staffs to accommodate them. A restudy of original Mission 66 program is under way.

The intensive use made during the past year of new facilities and services attested to the soundness of the plans for development, management and protection of the parks under Mission 66. New visitor center buildings, roads, trails, campgrounds, and other facilities were scheduled to open for public use during calendar year 1959, and many contracts have been let for further construction.

During the past fiscal year, 710 projects involving an investment of \$59,083,000 were either placed under construction or committed for construction, and an additional 708 projects worth \$36,616,000 were completed. Since Mission 66 was launched, 1,946 construction projects involving an investment of \$96,459,000 have been completed.

While construction projects may have provided visitors with dramatic examples of Mission 66 progress, much was accomplished "behind the scenes" to better protect the wilderness and the wildlife and the priceless historic buildings and treasures that have been entrusted to the care of the Department of the Interior.

During the year, 218 new permanent employees were hired to manage, protect, and maintain the parks. Total staffing under Mission 66, has increased almost 10 percent from about 7,200 permanent and seasonal employees on June 30, 1956, to nearly 8,000 on June 30, 1959.

Thirteen new visitor centers have been placed in operation and 20 others were under construction this year.

With the completion of the final stages of the Jamestown Trail Road in Colonial National Historical Park, the Heart of the Hills Road in Olympic National Park, and the entrance road at Arches National Monument, a total of 20 miles of new park routes were opened to the public.

Outstanding among the major roads projects placed under contract during the year were: The Thornton Gap Interchange and approaches at Shenandoah National Park; reconstruction of Union Avenue at Vicksburg National Military Park; the entrance at Montezuma Verde National Park, paving of the Lassen Peak Highway at Lassen Volcanic National Park, reconstruction of the South Entrance Road at Zion National Park, reconstruction on the Jackson Lake Road at Grand Teton National Park and the construction of grade separations on 14th Street and the Mall in the District of Columbia.

The National Parkways program also continued at a high rate of construction and concentrated on closing gaps of Parkway construction and providing additional visitor facilities along the completed sections. The Federal-Aid Highway Act of 1958 provided \$16 million authorization which was programed for the Blue Ridge

rkway in North Carolina and Virginia; Foothills Parkway in Tennessee; George Washington Memorial Parkway in Virginia and Maryland; Natchez Trace Parkway in Alabama, Mississippi and Tennessee; and Rock Creek and Potomac Parkway in Washington, D. C.

The National Outdoor Recreation Resources Review Commission was established in June 1958, by the 85th Congress to conduct a nationwide survey of the outdoor recreation resources of the nation and to develop recommendations for such policies and programs that will assure adequate quantity and quality of outdoor recreation opportunities to meet the nation's increased future population needs.

An earlier recreational study program, started by the National Park Service in 1936, to plan for the establishment of outdoor recreation areas by all levels of Government—Federal, State, and local—was accelerated under the Mission 66 program—is now tied in closely with the National Outdoor Recreation Resources Review Commission.

In the field of planning and surveys excellent progress was made during the year. Under the long-range National Park System plan, special staffs in the Regional Offices continued taking inventory of historic and scientific resources that have primary value for park and recreation purposes. Analysis of the inventory will ultimately establish what areas possess nationally significant values and merits possible status as units of the National Park System.

Nationwide recreation planning was concentrated on the inventory of existing recreation areas and the forecasting of future needs. About 85 percent of the inventory and evaluation of areas administered by State and local agencies was completed.

Looking into the future, to the years 1975 and 2000, good starts have been made in determining the needs for park and recreation areas in those years and the potential areas with outstanding recreation resources which would fill the future needs of the National Park System.

During the fiscal year, 24 laws directly affecting the National Park Service were enacted by Congress. An outside-the-park administrative site for Yosemite National Park, was authorized at El Portal, Calif., and a suitable boundary for Everglades National Park in Florida was fixed. Authority was granted to develop and complete Jefferson National Expansion Memorial at St. Louis, Mo., according to approved plans. Grand Portage National Monument in Minnesota was authorized, and the General Grant National Monument in New York City was officially established. The Minute Man National Historic Site in Massachusetts was established by Secretary of the Interior's Executive Order establishing Horseshoe Bend National Monument.

Park in Alabama was signed by the President on August 11, shortly after the close of the fiscal year.

The Department proposed legislation, later introduced, to preserve certain shoreline areas. If enacted, it would establish the basic principle that it is in the national interest to set aside significant portions of shore areas for this and future generations. The proposal would authorize Federal preservation of three shoreline areas possessing national significance. The Secretary of the Interior would have the authority to designate such areas.

Other pending legislation would authorize Bent's Old Fort, Colorado, Fort Bowie and the Hubbell Trading Post, both in Arizona, to be established as national historic sites; the preservation of Arkansas Post in Arkansas as a unit of the System; establishment of the Minute Man National Historical Park, Mass.; and establishment of the Chesapeake and Ohio Canal National Historical Park, Md.

The Department endorsed those proposals and, in addition, asked that Dinosaur National Monument be given the status of a National Park, and recommended legislation to provide an adequate basis for administration of the Lake Mead National Recreation Area. At the fiscal year's end the Department was giving sympathetic consideration to a recommendation that a 147,000-acre area in the Snake Range of Eastern Nevada, to include Wheeler Peak and Lehman Caves National Monument, be sought for establishment as a National Park.

River Basin and Regional Studies

Investigations continued on the recreation potentialities of the Columbia River Basin and the Delaware River Basin. The report on findings of the Missouri River Basin-Wide Recreation Survey was submitted. The report on recreation resources of northwestern California was delivered to the Pacific Southwest Field Committee for distribution.

Special assistance was provided to Hawaii on an inventory of existing and potential recreation areas. Draft reports were prepared on the recreation potential of Alaska, and assistance was given to Utah and Colorado in the formulation of plans for new State park systems.

Mission 66

Started in 1956, Mission 66, in a sense, came of age in 1959. Since a continuous, long-range program requires many preparatory steps



development of improved roads and parking areas under Mission 66 none too soon as shown by this throng of visitors at Yellowstone National Park.

must build up gradually. During the initial stage, much more energy and money are applied than can be extracted as immediate benefits.

By the end of 1959, however, with many programs and projects started in earlier years coming to maturity, the use benefits of Mission 66 assumed a dominant position. Mission 66 is now in good balance, and the effort and funds being invested in new projects and programs are equalled or exceeded by the benefits resulting from completion of facilities and the maturing of programs that started in earlier years.

It is very important that the program maintain this equilibrium as it progresses throughout the remaining 7 years of Mission 66, not only for reasons of economy and efficiency, but to keep pace with the demands of increasing park travel as well.

Mission 66 cannot be considered apart from the full National Park Service program—they are the same. The accomplishments of Mission 66 are the accomplishments of the Service, and are detailed in other sections of this report.

The following highlights are cited both to illustrate the progress of the program and to demonstrate the advantage of long-range planning when provided with the support necessary for the program to go on full schedule.

Lands were acquired and plans decided which will result in removal of many administrative, operating, and employee housing structures from congested Yosemite Valley, and their relocation at El Portal, Calif., just outside the boundary of Yosemite National Park.

The basic development of Mather Village in Grand Canyon National Park, Arizona, was completed, and some of the facilities placed in use. This development will accomplish the expansion and decentralization of public use developments, and eventually effect the restoration of the natural scene on the rim proper, much as has been done at Canyon Village in Yellowstone National Park, Wyoming-Montana-Idaho.

Wilderness research projects, in cooperation with universities and specialists, were started in the Rocky Mountain and Sierra parks, to assemble knowledge supporting more effective preservation of natural and wilderness values.

The completion of new visitor use facilities in Everglades National Park, Florida, stimulated the resolution, after many years of negotiation, of boundary and land problems in this park.

The flexibility of the Mission 66 program was demonstrated as camp-ground development was stepped up in response to the very rapid increase in camping evident in the last 2 years.

Interpretation and presentation programs were greatly strengthened as 13 new visitor centers were placed in operation.

For the first time, Isle Royale National Park, in Michigan, became adequately accessible with the launching of the 96-passenger motor craft, the *Ranger III*.

With all activities moving forward and showing results, the Mission 66 staff work focused upon the internal functions of the Service seeking ways to achieve more efficient operation, effective use of manpower, better and more rapid planning procedures, improved competence in personnel, and greater economy. In these fields, four items are especially worthy of mention:

1. Two attractive, full-color bulletins were produced, designed to invite into government service men of highest competence and quality. The first pertains to the uniformed field force—rangers, naturalists, historians, and archeologists. The second is addressed to the professions of landscape architecture, architecture, and engineering.

2. Prospectuses were prepared proposing the establishment of the National Park Service training school at a permanent location and in permanent facilities. The recruitment of highest quality personnel, and the maintenance of the highest degree of competence, are basic to good public service.

3. In order to reduce the disparity between parks to a more comprehensible and manageable basis, to provide a greater degree of consistency, uniformity, and economy of operation, and to permit more specific delineation of responsibilities and relationships, the parks administered by the Service were classified in five management groups. The organizational pattern designed for each group is consistent with the needs of the parks comprising each group, and with relationships with the Regional Offices.

4. A study of planning and management procedures resulted in new format, new content, and new procedures for preparing Master Plans, and the scheduling of Master Plan revision for all parks over the next 3-year period. The new Master Plan will not only consolidate into one document several separate planning instruments, but will provide a sounder basis for development planning, extend the Master Plan concept into the management field, and streamline procedures for preparation and approval of this basic instrument of park administration.

Interpretation

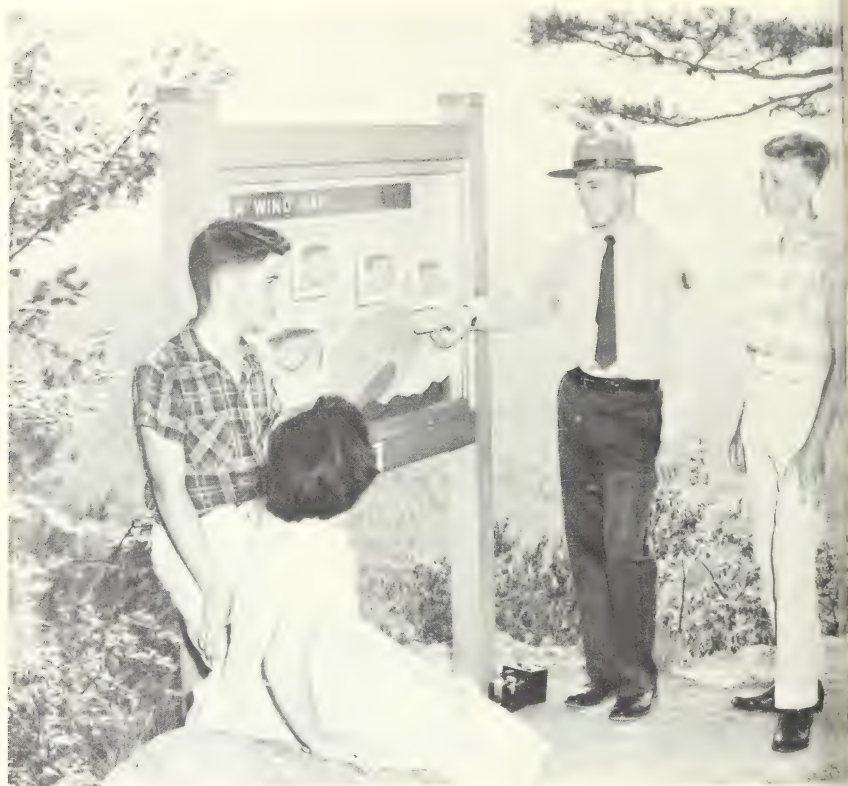
The interpretive program of the National Park Service provides educational service on a national scale. In the 1958 calendar year, more than 58 million people visited the 181 scenic, scientific, historical and archeological and recreational areas included in the National Park System.

Visitors want to appreciate and understand what they see and ask questions that must be answered accurately and completely. To answer the questions of park visitors concerning geology, natural history, and archeology of the parks is the assignment of the interpretive program of the Service.

Park visitors find inspiration at Jamestown, on the Oregon Trail or Fort Laramie, or on the great battlefields of the Revolution and the Civil War. The Grand Canyon, the beautiful mountains and streams, or a wilderness area in the National Parks, gradually comes to symbolize the nation in their minds, so that the type of knowledge gained from the interpretive program of the parks promotes patriotism and good citizenship. The nature and scope of the Interpretive Program has been greatly improved and accelerated under Mission 66.

Service to the Public

To enable the visiting public to get the most out of their visit to the parks through understanding and appreciation is the primary



Park historians add to the understanding and enjoyment of park visitors through talks and tours.

tive Program provides Visitor Centers for orientation, for information, and other conveniences which the visitor needs in visiting a park or historical area.

The Visitor Center usually includes a museum or exhibit space in which the story of the area can be told in an interesting and attractive manner. These are not museums in the regular sense but they display valuable specimens related to the park story and the technique of presentation is that of the museum.

Collectively these park museums, and the collections at those that have special collections, constitute one of the largest and most important museum systems in the Nation. In Independence National Historical Park, Phila., for instance, the Service has in its custody the Nation's largest collection of portraits of the founding fathers of the United States. The Jamestown Visitor Center in Virginia has an enviable collection of early 17th century objects relating to our Colonial history.

In addition to the Visitor Centers and museums, the Interpretive Program provides expert guide service, self-guiding trails, trailside exhibits, and automatic or visitor-operated audiovisual aids and films. To make history and natural history live and to make nature intriguing is also an objective of the Interpretive Program. The number of visitors utilizing interpretive services during the calendar year 1958 increased over the preceding year's total at a 69 percent greater than the rate of increase in total park visitation. While the count of visitors participating in conducted trips hearing interpretive talks by naturalists and historians remained under 10 million, the significant advance in 1958 was in the use of self-guiding devices. Additional self-guiding facilities available in 1958 raised the total of estimated contacts through this medium to over 30 million, a gain of 20 percent. Visitor centers and ranger attended stations recorded a gain to a total of 20.5 million visitors.

Visitor Centers

Visitor Centers built so far under Mission 66 have proved their value in terms of increased enjoyment and appreciation of the parks. Visitors have found these multi-purpose buildings convenient, efficient places for learning quickly what to see and do during their visit in a park. During this fiscal year 13 new Visitor Centers were completed and opened to the public, and 20 more were under construction.

Among the new Visitor Centers are two that marked important anniversaries. The one at Abraham Lincoln National Historical Park, Ky., was built 150 years after Lincoln's birth. Exhibits there tell of his father and mother and their frontier life.

The Visitor Center at Theodore Roosevelt National Memorial Park, N. Dak., was completed during the centennial year of his birth. It orients people to the widely scattered features of the park and tells of the significant influence Roosevelt's experiences as a hunter in the Badlands had on his life and work.

Other Visitor Centers opened for the public were Moores Creek, Juniper Pine Cactus, Pipestone, Richmond, Yellowstone Canyon, Grand Canyon, Fort Union, Hopewell, Carlsbad, Peaks of Otter, Oberland Gap, and Colter Bay (Grand Teton).

Museum Program

An important byproduct of intensive work on museum interpretation is the more precise information about the historic and natural resources

lections being preserved in the parks. There are over 2,300,000 specimens, most of them carefully selected for their value in understanding and interpreting the parks and the national historical areas. Plans were developed for a critical review of the contents of all park collections to increase their value and use.

Park collections continued to receive generous donations. At the Spanish Embassy in Washington, D.C. on October 11, 1958, the Minister of the Army of Spain presented to Under Secretary of the Interior Elmer F. Bennett, a series of early Spanish arms for use at Castillo de San Marcos National Monument in St. Augustine, Fla.

Mr. William H. Robinson, Jr. of Gloucester, Mass., presented the National Park Service a bronze Spanish mortar and bed about 1780. It will be mounted at Castillo de San Marcos.

The staff of museum preservation specialists applied skillful treatment to rare and valuable specimens for 28 parks. Their work included preservation of the foundation timbers of the flag pole from which the Star Spangled Banner flew during the bombardment of Fort McHenry in 1814. They also restored the celebrated Thomas Moran paintings of the Grand Canyon and Yellowstone in the Secretary's conference room, as well as important portraits

New Visitor Centers, such as shown at Cumberland Gap National Historical Park, are an integral part of Mission 66, and offer greater park understanding and appreciation through orientation exhibits, museum displays, information and other visitor facilities.



in the Independence Hall collection and from Morristown National Historical Park, N.J.

The Eastern and Western Museum Laboratories worked at full capacity and supplemented their efforts by contracts with exhibit makers, so great was the demand for exhibit preparation.

Audio-Visual Planning and Installations

Distinct progress in the audiovisual field was made during fiscal year 1959 by the Audio-Visual Laboratory. Outstanding were installations of visitor-activated repetitive motion picture projectors: Dinosaur and Craters of the Moon; the installation of four improved visitor-activated cabinet projectors elsewhere; development of battery-operated message repeater for remotely located audio stations, and complete audiovisual installations in assembly rooms of major visitor centers providing both automatic and manual presentations.

Roadside and Trailside Interpretation

In 1959, the development of many new roadside and trailside interpretive facilities strengthened the Interpretative Program. These assist visitors who like to guide themselves, especially in heavily visited areas where the demand for guidance exceeds the park staff. New interpretive markers were installed on the Jackson Hole Highway, Grand Teton National Park, Cades Cove and Smokemont Hills, Great Smoky Mountains National Park; Arches National Monument, Beaver Dam, and the Natchez Trace Parkway.

Research

Archaeological excavations within areas administered by the National Park Service were carried out in Chaco Canyon, at Montezuma Well, and at Tuzigoot. A survey of the north rim mesa in Walnut Canyon was completed and the Southern Illinois University surveyed the area south of Frijoles Canyon in Bandelier as part of a long-term research program centering on the Pueblo of Cochiti. Reports on excavations at Petrified Forest and El Morro are being prepared and an analysis of survey collections from Organ Pipe Cactus National Monument is now underway.

Archaeological research in relation to construction projects was carried on at Badlands, George Washington Carver, Fort Laramie, Pecos Ferry, Independence, Fort Union and Fort Mifflin. Work at Fort Frederica was completed during the year. An important project involving studies in ecology, soil analysis, and



Wayside exhibits, such as this one of the Battle of Moore's Creek in North Carolina, aid young and old in understanding the significance of our Nation's history.

and geochronology as well as archeology was begun at Wetherill Mesa in Mesa Verde under the cosponsorship of the Service and the National Geographic Society.

The extensive salvage archeology program conducted by the National Park Service through financial cooperation with other Federal agencies and State and local institutions is being continued in the Missouri River Basin where several Smithsonian Institution crews were in the field. In the Upper Colorado River project the University of Utah, the Museum of Northern Arizona and the Museum of New Mexico cooperated with the Service in survey and excavation work in the Glen Canyon and Navajo Reservoirs.

Several projects are under way in Texas through cooperation with the University of Texas, such as the Diablo and Cooper Reservoir Work continued in the Dalles and John Day Reservoirs in Washington and Oregon, while excavations were carried on at Hartwell in Georgia, Walter F. George in Alabama, and numerous small areas in the eastern United States.

In natural history, geological research is continuing in cooperation

h the Department's Geological Survey in several areas involving geology and geological mapping. Additional glacier studies are being conducted at Olympic and Glacier Bay as part of the International Geophysical Year program in cooperation with the American Geological Institute. Other cooperative research in progress includes geological studies at Cape Hatteras and Virgin Islands, and photographic mapping at Badlands. The Service also is continuing hydrothermal studies at Yellowstone initiated last year.

The Service initiated biological research on bighorn sheep at Death Valley and Dinosaur, and cooperative studies on the elk in Jackson Hole, Wyo. Research was begun on the wolves and moose of Isle Royale in cooperation with Purdue University; and grizzly bear studies at Mount McKinley, carried forward by the University of Alaska. Studies on the fragile alpine environments at Sequoia, Rocky Mountain, and Grand Teton continued. Marine fishery research progressed at Everglades and Virgin Islands, and the Department's Fish and Wildlife Service continued work on trout at Yellowstone, Rocky Mountain, Shenandoah, and Great Smoky Mountains.

Historical and architectural research on the Assembly Room of Independence Hall, Congress Hall, and Old City Hall and at Appers Ferry continued. Historical research at Fort McHenry was brought to a conclusion with many fruitful results.

Important historical research was undertaken on Booker T. Washington and George W. Carver. A major study of the history of the use of Federal Hall, first Capitol of the United States, was completed.

National Survey of Historic Sites and Buildings

The National Survey of Historic Sites and Buildings, reactivated after Mission 66, continued to show good progress. The following studies were completed: (1) Theme IV, Spanish Exploration and Settlement; (2) Spanish Colonial Sites in the Panama Canal Zone; (3) Theme V, French Exploration and Settlement; (4) Theme XI, Advance of the Frontier, 1763-1830; (5) A Special Study of the Lewis and Clark Expedition; and special studies of other phases of our Westward Expansion, namely (6) The Santa Fe Trail, (7) Hubbell Trading Post, and (8) The Mining Frontier.

Wildlife

Special emphasis was given to utilizing the knowledge gained from wildlife research in the interpretive programs of the national parks.

creased attention was given to the interpretation of fishes in their natural habitats. The fascinating marine life in the waters of Virgin Islands was featured.

Other examples showing the wide variety of opportunities afforded in this field by the National Park System are the wolves of Isle Royale, the desert bighorn sheep of Death Valley, and the gray whales which migrate in view of thousands of visitors at Cabrillo National Monument in California. The expanding research program on biological resources promises to provide a great wealth of information for public education and enjoyment as well as facts needed for the conservation of these important resources.

Staffing

The National Park Service—with its almost 60 million visitors seeking instruction in outdoor laboratory courses in history, geology, natural history and archeology—must have an adequate staff not only to give answers directly or to conduct guided trips, but also to plan the museum story and trailside exhibits. In 1958, the interpretive professional staff numbered about 120 historians, 95 naturalists and 37 archeologists. To cope with the increased responsibilities of the interpretive program under Mission 66, 12 new permanent naturalist positions were established during the year; 12 new historians and 7 new archeologists were employed.

Archeology, which since 1935 had been incorporated within the Branch of History, was established as a separate Branch of Archeology. The staff of the Museum Branch was increased by three.

Memorial Commission Activities

The National Park Service serves as the fiscal and cooperating agency for the Civil War Centennial Commission, Lincoln Sesquicentennial Commission, Boston National Historic Sites Commission and the Hudson-Champlain Celebration Commission.¹

The Civil War Centennial Commission with headquarters at 1000 Jackson Place, Washington, D.C., held its annual meeting April 15-16 in Richmond, Va. The Executive Director and Chairman met frequently with State commissions in planning for the centennial observances. The National Park Service collaborated with the Commission in producing a film on "Planning for the Centennial of the Civil War."

The Abraham Lincoln Sesquicentennial Commission, scheduled to function until March 1, 1960, sponsored or cooperated in many observances including a joint session of the Congress on February

2, when Carl Sandburg was principal speaker, a redesign of the Lincoln Penny, and an issue of four special stamps. Its secondary school program will reach 97 percent of the high schools in the United States, public, private, and parochial. It also has an active college program. *Lincoln Day-by-Day*, a four volume work on his activities, is in the process of preparation for publication.

The Boston Historic Sites Commission completed a major portion of its studies on the preservation and interpretation of Colonial and Revolutionary historic sites in Boston and vicinity by the issuance of the Lexington-Concord Battle Road Report, published as House Document No. 58, 86th Congress. The final report of the Commission covering sites in Boston proper will be completed in 1960.

The Hudson-Champlain Celebration Commission, with headquarters in Federal Hall, New York City, was established by act of Congress, August 8, 1958. The Chairman has a commission of 21 members who have sponsored or will sponsor appropriate observances in New York, New Jersey, Vermont, and Canada, throughout the spring, summer, and fall months.

Information and Publications

Growing public interest in the great recreational, educational and historic assets contained within the National Park System was reflected throughout the year by mounting requests for informational publications and factual reports.

Although some 12,000,000 free informational publications were produced and about 500,000 were sold by the Government Printing Office, demand exceeded supply.

The thirst for knowledge about the National Parks, Monuments and historic areas was worldwide. During the year requests were received from citizens of 58 foreign countries for National Park Service informational publications.

Although the great bulk of park publications are distributed in the parks themselves, some 55,000 mail inquiries for park information were received in the Washington office.

Handbooks on the historical significance and natural history of the areas and reports on the scientific findings of researchers supplemented the free informational program. Two new handbooks—Ford Courthouse National Military Park, and Chalmette National Historical Park—were added to the handbook series during the year. A revised edition of the Saratoga National Historical Park handbook was issued and a handbook on tree bracing was published and reissued.

Through many press releases, the public was kept informed of the progress of Mission 66 and other park matters of national interest. Individual assistance was provided to magazines, newspapers, radio and television stations, and motion picture companies in the preparation of materials concerning the parks.

Division of Ranger Activities

Throughout the past year, the Park Rangers successfully met their dual responsibility of serving as friend and protector to millions of visitors and as protector of the parks and the scenic, scientific, and historic values they contain. Their work cannot be performed within the schedule of an 8-hour day or 40-hour week and Park Rangers continued to work many additional hours uncompensated for only through the satisfaction that comes from serving and helping others. Public recognition and appreciation of their efforts was evidenced by the large number of complimentary letters that were received by the Service from visitors whom they had helped.

The new Division of Ranger Activities in the Washington Office completed its first full year of operation. Good progress was made in the development of much needed policies and policy guidelines covering important activities of Park Rangers. These included policy statements on law enforcement and mountain climbing.

A joint conference of Chief Rangers and Interpreters was held in Washington, D.C., during March. This is the first such conference ever held that included the participation of every Chief Ranger in the Service. It provided an excellent opportunity to study and discuss the full scope of Ranger Activities as they are found throughout the entire National Park Service.

Of growing concern to Rangers in the larger, more heavily used parks, is the proportion of their available time now required to conduct protection and visitor service activities in the developed areas and along park roads. This situation has resulted in too little time left to regulate and control the increasing public use of the back country and to protect park values found there.

During the year a task force of field employees was called to Washington where they studied Service uniform regulations, made recommendations for revisions needed to effect a higher degree of standardization, better appearance, and prepared a handbook outlining how the uniform should be worn and maintained.

The National Park Service Training Center at Yosemite National Park completed its second year of highly successful operation.



The awe-inspiring majesty of nature draws millions of Americans to our
parks annually.

During the year, the Arno B. Cameron and Newton B. Drury Sessions were held which provided 51 young men in their first year employment with Service orientation and indoctrination together with some training in work techniques and skills. A young forester from Turkey, sent to this country by his Government to study national parks and forestry, attended the fall session of the training center.

Park Travel

The upward trend in park attendance was cyclically interrupted in calendar 1958 when total visits declined 1 percent to 58,677, from 1957's 59,285,000. Resumption of the upward curve was clearly evident during the second half of fiscal year 1959.

The collection of travel statistics and the analysis of public use has been reoriented toward measurement of park workload and determination of development priorities, staffing requirements, peak sign-load estimates, and need for services.

Mountaineering

The National Parks in the mountains of the West, and in Alaska, draw upon the hardy spirit of about 20,000 visitors annually who seek out the rugged summits for physical accomplishment.

Search, rescue, or evacuation missions were incident to five fatalities and 20 other accidents with potentially serious consequences.

The 3,600 foot face of El Capitan in Yosemite National Park was climbed by a group of expert mountaineers on November 12 after about 45 days of effort expended at various times from a start made in July 1957.

On July 2, two parties made the first successful ascents of Mount McKinley National Park, Alaska, since 1954.

Boating

The full force of power boating is felt on park waters and the need has arisen to study closely this popular form of use to determine the degree of protection and control necessary to conserve the water-related resources and prevent injuries or deaths.

Winter Use

The Everglades, Hawaii, and Virgin Islands offer respite from the cold in warm waters under tropic skies. Rainier, Yosemite



Many national parks offer spectacular views and are centers for water activities including boating, fishing, and water skiing.

Compic, or Rocky Mountain with a cover of snow and frosty brightness bring opportunities for family participation in and appreciation for outdoor activities and scenic splendor. Yearlong in these parks and in Great Smoky Mountains, Hatteras, Blue Ridge, Sequoia people by increasing numbers are finding inspiration and refreshment.

Camping

In 1958, camping pursued its strong upward movement. It rose 11 percent from 4,201,000 camper days in 1957 to 4,665,000 in 1958. Campgrounds have been burdened beyond capacities, but this appropriate and beneficial experience in the parks brings enjoyment to many that could be provided in no other way. Small travel trailers are growing in camper preference over tents.

Wildlife and Fish Management

This was the first full year that management responsibilities in wildlife conservation has been a function of the Division of Ranger Activities. To consider questions in management biology, 50 Wildlife Rangers were designated by the Superintendents, and 1000 Elt a dozen reports on fish and wildlife management (over 1000

received. With assistance from cooperating agencies, wildlife productions were made at Glacier, Mammoth Cave, Yellowstone, Grand Canyon, and Rocky Mountain.

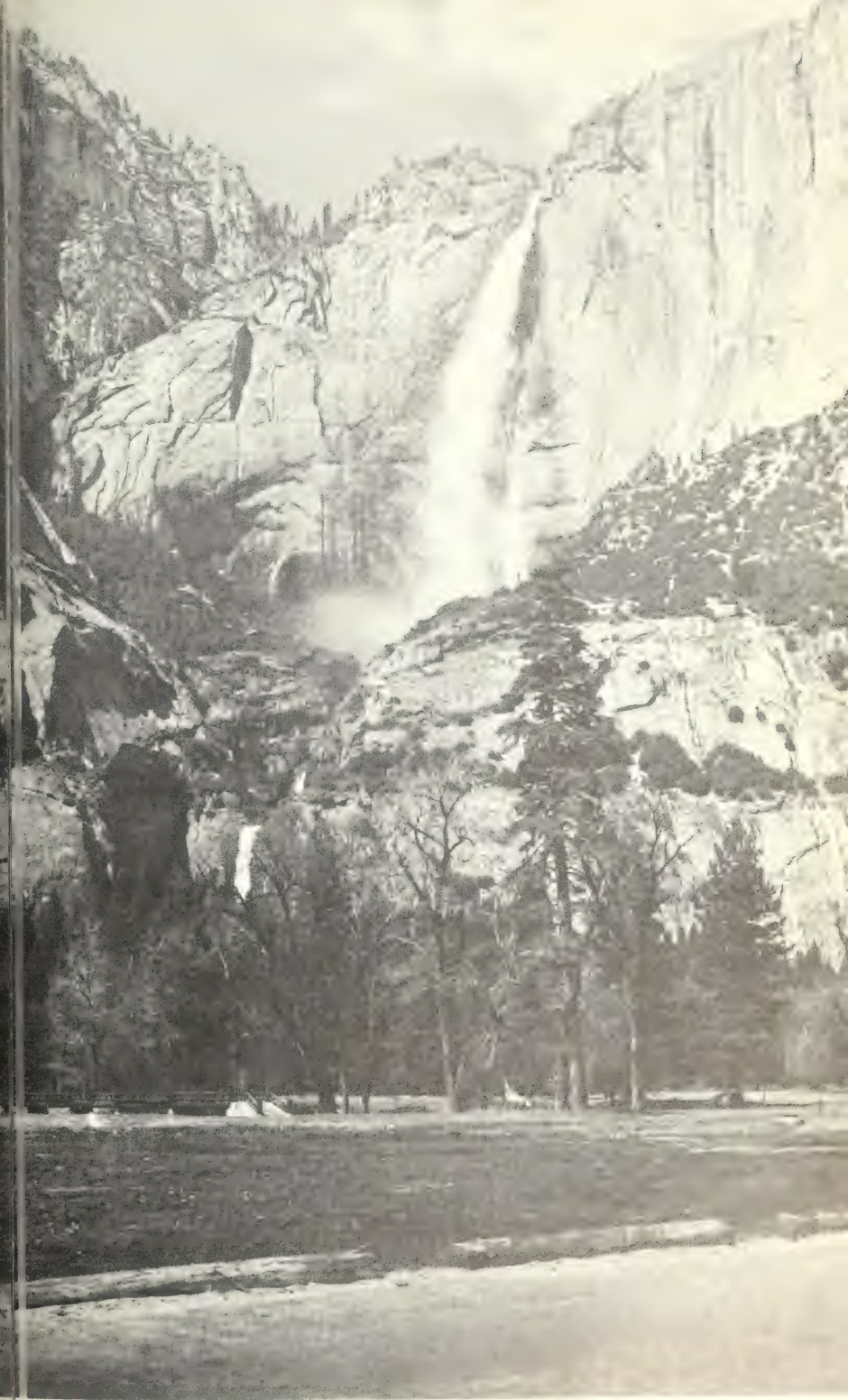
Fish were planted in 13 areas, and in an attempt to reestablish bighorn sheep, five were released at Theodore Roosevelt National Memorial Park.

Grazing

Each year for the past several years there has been a light decrease in open-range use by domestic livestock in the western national parks and monuments. This trend continued in 1958. The elimination of this land use will not be realized until the distant future because of the life tenure of many of the permittees. However,

Below: A striking example of Mission 66 activities in improving the parks for the enjoyment and inspiration of this and future generations. This picture shows the falls in Yosemite Valley marred by an unsightly old building. *Opposite page:* The building has been removed, allowing for an unobstructed natural view of the spectacular falls.





progress is being made in eliminating livestock from public areas through the media of fencing.

Forest Fire Control

The Servicewide fire record for the year was generally a most successful one. The 333 fires which originated inside or entered park boundaries were below the previous 5-year average of 341 and the 1958 burn of 3,770 acres was less than any year reported during the previous 10 years.

The 1958 record of 209 lightning-caused fires and 124 man-caused fires is significant for usually fires caused by man's carelessness exceed those started by lightning. Approximately 3,000 men devoted more than 91,000 hours on fire suppression activities.

White Pine Blister Rust Control

Initial eradication of ribes (wild currants and gooseberries), the alternate host of the disease, has been completed on 94 percent of the 375,404 acres included in control units. Eighty-one percent of the control area in 14 areas administered by the National Park Service now only require infrequent workings in order to maintain a "ribes free" or maintenance status.

Recreation Resource Planning

Special staffs in the Regional Offices are taking inventory of scenic and scientific resources that have primary value for park and recreation purposes. Preliminary analysis of the data is being made to identify areas that possess nationally significant values and merit consideration for possible status as units of the National Park System. Based upon the initial inventory and evaluation, plans are being drawn for comprehensive investigations of desirable and suitable areas.

Forest Pest Control

Forest insect and disease conditions were generally less severe in the parks and monuments this year and maintenance control projects were successful in keeping losses from most pests at a minimum. The most destructive outbreaks were the continuing Southwestern pine beetle infestation at Bandelier National Monument and the mountain pine beetle attack associated with the lodgepole needle miner infestation at Yosemite National Park. Spraying developed

applied in and near the public use area at Bandelier appears have been unusually successful. Mountain pine beetle control work has been continued at Yosemite National Park in conjunction with the intensive research program of the Department of Agriculture's Forest Service under way there to develop a successful control of lodgepole needleminer now attacking over 50,000 acres within the Park.

New Areas Established

In accordance with authorizing legislation, the General Grant National Memorial, N. Y., was officially established by acceptance May 1, 1959, of the deeds transferring the property from the Grant Monument Association to the United States.

The 8-acre Minute Man National Historic Site, Mass. was established by Secretarial order on April 14, 1959. Deeds to lands donated by Horseshoe Bend National Military Park, Ala., were accepted by the United States, and an Executive order establishing the Park was issued early in fiscal 1960.

The possibility of preserving a representative portion of the tall grass or true prairie in Pottawatomie County, Kans., as a unit of the National Park System is being considered by the Department.

The proposal culminates several years of study by the National Park Service of remaining portions of the tall grass prairie. Similar studies are in progress to determine what possibilities remain to preserve examples of the important short grass or mixed prairie. Preliminary studies of the national park potentialities of the Snake Range in eastern Nevada were completed and are being considered by the Department.

Boundary Adjustments

During fiscal year 1959, the 85th Congress authorized boundary adjustments which included additions of lands at Cape Hatteras National Seashore Recreational Area, Cowpens National Battlefield, Gloria Dei Church National Historic Site, Independence National Historical Park, and Isle Royale and Yosemite National Parks; a small deletion of lands at Sequoia National Park; and boundary additions and deletions at Everglades and Kings Canyon National Parks. Legislation was also enacted which authorized boundary changes at Vicksburg National Historical Park, Hot Springs National Park, Natchez Trace Parkway, and Death Valley National Monument. Additions to Cabrillo, Capitol Reef and Fort Pinos National Monuments and Independence National Historical Park were accomplished by Presidential proclamations.

Bills introduced in the 86th Congress would authorize boundary adjustments at Independence National Historical Park; Fort Donelson and Kings Mountain National Military Parks; DeSoto and Wright Brothers National Memorials; Devils Tower, Dinosaur, Edison Laboratory, Fort Vancouver, and Montezuma Castle National Monuments; San Juan National Historic Site; and Mount Rainier and Zion National Parks. Another bill would permit use of Federal funds to acquire lands at Antietam National Battlefield Site.

Officials of the McGraw-Edison Co. have offered to donate Glendon, the home of Thomas A. Edison in West Orange, N. J., to the United States for preservation with the Edison Laboratory established as a National Monument in 1956. Negotiations are now under way looking toward inclusion of the Edison Home in the National Monument.

Advisory and Consultative Assistance

Forty-six States, Hawaii, and Puerto Rico were furnished assistance on 426 occasions on a wide variety of problems. Of special significance is the assistance furnished by the Interpretive Specialist who was assigned to the branch in the spring of 1958. He has provided interpretive planning assistance in 12 States on 20 occasions, including major projects currently underway in Georgia, Maryland, Michigan, South Carolina, West Virginia, and in Breckinridge Interstate Park in Kentucky and Virginia. Additionally, he has surveyed interpretive programs in 95 State and local areas in 24 States. There is evidence that State and local park authorities are becoming increasingly interested in interpretation.

Cooperation was extended to the National Conference on State Parks in a study which was published by the Conference under the title Revenue Bonds for State Park and Recreation Area Development—Report on Their Use and Features. This 26-page report with 77 pages of appendices discusses the advantages and disadvantages of this method of financing and gives an account of the programs in 12 States.

Real Property Disposal

Thirty-three Federal surplus properties totaling 2,095 acres were recommended to General Services Administration for conveyance to the States and their political subdivisions for park, recreation, and historic monument purposes. The Service now has responsibility

enforcing compliance with the conditions of the deeds on a total of 145 properties involving 24,383 acres.

Recommendations were furnished to the Department's Bureau of Land Management on 54 applications from State and local agencies to acquire public-domain lands for park and recreation purposes.

Park Practice Program

The program of exchanging park administration practice and ideas continues to grow. Every State now participates and many municipal, county, and regional park authorities, as well as private recreation and recreation organizations, colleges and universities, and a number of foreign nations are contributing ideas and participating. Municipal and other agencies now comprise more than 40 percent of participant membership; foreign participation has doubled during the past year. Total membership in the full program now exceeds 1,000, an increase of 25 percent.

Much of the material presented through the three publications of the program—Design, Guideline, and Grist—are being quoted in other publications and are being used as training materials in universities offering courses in park administration.

National Park Statistics

The 1958 edition of this annual publication produced in fiscal year 1959 shows that there are 2,335 State parks and related types of recreation areas embracing 5.4 million acres; that attendance exceeded 237 million, including 17 million overnight visitors; that the States spent \$47 million for operation and maintenance and \$22 million for capital improvements; and that they employed 10,000 year-round and 9,982 seasonal employees. Perhaps the most significant revelation is the use by 13 million campers, an increase of 25 percent.

Nationwide Recreation Planning

The work on nationwide planning for nonurban recreation resources was concentrated on the inventory of existing recreation resources and the forecasting of future needs. Inventory and evaluation of areas administered by State and local agencies was about 80 percent completed. Work is underway to determine the quantitative requirements for parks and recreation areas for the years 1970 and 2000 and to inventory potential areas having outstanding recreation resources.



Thundering surf at Acadia National Park, Maine, brings welcome rest and relaxation from the tensions of present day city life.

Seashore Surveys

The Pacific Coast Recreation Area Survey was published. Distribution of the report aroused considerable interest.

Field studies were completed on the Great Lakes Shoreline Survey.

River Basin and Regional Studies

Investigations continued on the recreation potentialities of the Columbia River Basin, in cooperation with the Recreation Subcommittee of the Columbia Basin Inter-Agency Committee, and the Delaware River Basin, where draft reports were being prepared on portions of the States in the Basin, in cooperation with State agencies. The report on the Missouri River Basin-Wide Recreation Survey was printed, and the report on recreation resources in northwestern California was delivered to the Pacific Southwest Field Committee for distribution.

Special assistance was provided to Hawaii on an inventory of existing and potential recreation areas, and preparation of a plan for a system of parks; draft reports were prepared on the recreation potential of Alaska; and assistance was given to Utah and Colorado in the formulation of plans for new State park systems.

Reservoir Development and Management

Work carried on under the provisions of section 8 of the Colorado River Storage Act included installing an acting superintendent in

Glen Canyon National Recreation Area project, opening a temporary project office at the Wahweap public use development site, preparing preliminary master plans for two major public access points at the future Flaming Gorge Reservoir and for the Navajo Reservoir area, and undertaking negotiations for administration of recreation resources of the Navajo Reservoir.

Recreation reports prepared included general development plans for 14 reservoir projects, reconnaissance or planning reports for 5 projects, annual field review of 36 reservoir recreation areas, and special studies of recreation use of 2 reservoir recreation areas. Management agreements were negotiated for operation and maintenance of 10 reservoir recreation areas.

Recreation Research

Special studies being made under contract for the Service included (1) a study to provide information on present and future needs for organized camping facilities to provide camping opportunities for children and young people and (2) the initial stages of a study for evaluation of the economic and sociological effects of recreation use of three reservoirs in the Missouri River Basin. Plans were made for nationwide sample interviewing for contract survey work on the extent of interest in nonurban outdoor recreation generally and in types of activities requiring publicly owned recreation space and facilities in order to help measure long-term demand for public parks and recreation areas and the types of outdoor-experiences that are sought.

Administration

For the third consecutive year under Mission 66, the Service's financial position was strengthened in 1959 through appropriation increases. There follows a comparison of the 1959 appropriations with those for 1958:

| Appropriation item | 1958 fiscal year | 1959 fiscal year | Increase (+) or decrease (-) |
|---|------------------|------------------|------------------------------|
| Land and Protection..... | \$14,527,094 | \$16,056,200 | +\$1,529,106 |
| Maintenance and Rehabilitation of Physical Facilities..... | 11,663,786 | 12,477,100 | +813,314 |
| General Administrative Expenses..... | 1,390,650 | 1,429,300 | +38,650 |
| Contract Liquidation (Liquidation of Contract Authorization)..... | 17,400,000 | 20,000,000 | +2,600,000 |
| Cash Appropriations..... | 31,000,000 | 30,000,000 | -1,000,000 |
| Debt (Amount by which Roads and Trails and Park-Contract Authorization exceeds or is less than cash appropriation)..... | 75,981,530 | 79,802,600 | +3,821,070 |
| New Obligational Authority..... | +15,768,500 | 13,700,000 | -2,068,500 |
| | 91,747,030 | 93,596,890 | +1,849,860 |

The net decrease in new obligational authority was brought about by the advancement of 1959 fiscal year contract authorization for roads and trails and parkways construction totaling \$14,761,000 for obligation during the latter part of 1958. This advance enabled the Service to get a significant portion of its 1959 roads and trails and parkways programs under way prior to commencement of the fiscal year. Disregarding this adjustment, new obligational authority for the 1958 fiscal year totaled \$76,981,530 and for 1959 it totaled \$81,962,600, making a total increase of \$4,981,070.

Improvement in Financial Management

Progress in the prosecution of the Service's plan for improvement in financial management continued throughout the year. The most significant achievement in this connection was the implementation of the plan and procedures for placing all of the Service's fixed assets under accounting control. This project, which includes inventorying and estimating the cost of all fixed assets acquired or developed prior to 1956, when the new accounting system was installed, was progressing at the close of the fiscal year and will be completed in 1960. Also at the close of the fiscal year, the Accounting Handbook was complete in draft form and ready for final revision.

Personnel

The volume and complexity of personnel work continued at a steady rate of increase that has been evident since the inception of Mission 66. To meet the demands of efficient and effective operation with comparatively little increase in staff, further delegation of personnel management authority to field officials was found necessary and feasible. Increased delegation of authority to Regional Directors and the Superintendent of National Capital Parks was effected, together with decentralization of personnel folders. This raised the delegated authority to the field from GS-11 to GS-13, with the exception of Superintendent positions. This also permitted a reorganization in the Branch of Personnel, resulting in a strengthened Employee Relations staff responsible for functions previously performed by two sections and in the streamlining of operations in the Appointments and Records Unit.

Merit Promotion Program

The Service's promotion program was revised to meet the requirements of the Civil Service Commission's and Department's new Merit Promotion Program.

Employee Relations

Director Wirth was one of 10 recipients of the Career Service Award for 1959 presented by the National Civil Service League, Washington, D.C.

The Service's recommendation of a Conservation Service Award to Dr. and Mrs. Harold S. Colton of the Museum of Northern Arizona was approved by the Secretary.

There was increased activity in the suggestion and superior performance phases of the Incentive Awards Program.

Employment

The Mission 66 Staff and the Branch of Personnel developed two active recruitment brochures, one for the uniformed services and the other for the design professions.

Classification and Wage Matters

Revised classification standards covering park naturalist positions were developed and approved by the Civil Service Commission.

Necessary position classifications were completed in connection with the establishment of the new Branch of Archeology.

A significant development in wage administration was the enactment of Public Law 85-872, which requires that wage rate increases be made effective within certain time limits after a wage survey is ordered. The new Supervisory Pay Plan, which was released by the Office of the Secretary in August 1958, was installed.

Career Development

As a part of the Service's Management Development Program, two Management Development Seminars for National Park Service managerial personnel were conducted during the past year.

The Branch helped arrange and conduct the Twentieth General Administration Training Course, held at the Region One Office in Richmond, Va., in March 1959, for selected employees regarded as

having potential for growth and development in administration. The Nineteenth General Administration Training Course was held in the Region Four Office in San Francisco, Calif. in October 1958.

Property and Records Management

Handbooks were prepared on contracting and procurement, property management, and will soon be distributed to the field. Substantial progress continues in establishing adequate records and inventories of museum specimens. A Quarters Subsistence Services Handbook was produced and distributed. At Yellowstone National Park an experiment is being tried in operating a service storehouse for perishable foodstuffs with a view to increasing efficiency and economy. If successful, the system will be extended to additional items and other parks.

Records Management

It was a progressive year in paperwork management. The Records Management Section participated in Records Management Workshop conferences conducted by the Department. A Directives Management Handbook was written establishing an integrated directives system. A Forms Management Handbook was written extending the forms program to the field. A listing of all Bureau forms with reference to the directive for each form, was published, resulting in the elimination of 51 forms. Two workshops, Form Improvement and Records Disposition, are being given Servicewide. Handbooks being written at the year's end include Correspondence Procedures; Reports Management; Files Management; and Records Scheduling and Disposition.

Safety

The Branch of Safety is making every effort to further organize and develop a more effective safety program to cover not only National Park Service employees and operations but visitors, concessioners' and contractors' employees and operations.

Visitor-Accident Fatalities

The visitor-accident fatality rate was reduced 16.3 percent. This is the third year in succession in which the fatality rate has been



Park views leave unforgettable memories to millions of visitors.

er one per million visitors. In 1958 there were 36 visitor fatalities which resulted in a ratio of 0.61 per million visitors, the best rate in the 12 years that such reports have been compiled. Of the 36 fatalities, 17 were drownings and 12 resulted from motor vehicle accidents.

Bear Incidents

Thirty-nine persons were reported having been bitten or scratched by bears during the 1958 season. This compared with 91 reported in the 1957 season, 109 in 1956, and 76 in 1955. Bears were responsible for 117 property damages during 1958 as compared to 126 in 1957, 106 in 1956, and 112 in 1955.

Motor Boat Activities

As a result of the Federal Boating Act of 1958, safety codes applicable to motor boat operations in parks are being developed. In cooperation with the Coast Guard Auxiliary, safety instruction courses are being set up in parks where motor boating is a popular activity.

Safety Committee

Practically all of the areas administered by the National Park Service either have active safety committees or someone of the staff designated to handle safety program activities. The Region Ten Office organized and conducted the first Bureau safety seminar at Grand Canyon National Park, with excellent results. The meeting of the National Park Safety Planning Committee submitted recommendations for improving the Service's safety program.

Operations

The year was marked by continued progress in providing additional public accommodations and improved services in the parks and by substantial gains in acquiring lands needed for park purposes. In addition, programming methods and procedures have been improved and the increased maintenance responsibilities resulting from facilities provided under Mission 66 are necessitating a "new look" at maintenance practices and techniques. It is believed that the results achieved will contribute materially to making the National Park System more enjoyable for the increasing number of visitors each year.

Public Works Planning

Meetings of the Departmental Public Works Planning Committee were attended to discuss methods of initiating and administering a public works program in event of a National Emergency. It was developed that the Service could contribute by producing a program of park projects within a thirty day period based on the Mission 66 Control Schedules. A program of projects which could be started within a twelve month period was prepared based on these schedules and on information received from the field. This program was submitted to the Committee.

Mission 66 Control Schedules

The Mission 66 Control Schedules for park developments were revised to reflect the addition of new areas, additional facilities needed to accommodate an estimated additional 10 million visitors during the Mission 66 period, and increased costs since the last schedule mission.

Advance Development Programs

To further facilitate the crystallization of ideas on the numerous details connected with development it was decided to prepare detailed annual programs for an additional year beyond the budget year, for a total of 3 years instead of 2. These data provide the basis for an orderly sequence of development; for detailed studies of individual projects; for obtaining survey data and for the preparation of preliminary plans. Each of these annual programs is tentative when first compiled, becomes progressively firmer as studies develop and is well established when due for submission with the annual estimates.

Maintenance

Maintenance and operational responsibilities of park staffs continue to increase at a rapid pace as additional facilities are completed under the construction phase of Mission 66. The increase is not only in numbers but more significantly is caused by the added complexity of the problems, particularly in respect to buildings and facilities which incorporate in their design many new materials and equipment requiring a wide variety of new maintenance practices, procedures and techniques.



New cottages for the use of park visitors are constantly being added to the Park System by private industry under Mission 66.

The season in many parks has been materially extended by keeping the roads open later in the fall and opening them earlier in the spring. In other parks additional roads are being kept open on a year-round basis. Operational efficiency in snow removal has been further improved by the acquisition of modern equipment.

Concession Authorizations

Sixteen concession contracts were negotiated. These included construction programs for Shenandoah, Yosemite El Portal administrative site, and Glen Canyon National Recreation Area, representing investments totaling about \$2.75 million dollars. Highlights in the field were the conclusion of contracts with the District of Columbia Armory Board for the construction and operation of a stadium on the East Capital Street site, and the Virginia Sky-Line Co., Inc., providing for a \$2-million improvement program at Shenandoah National Park.

Prospectuses

Nine prospectuses were issued soliciting offers for the operation of facilities at Lake Mead, Mount Rainier, Hot Springs, Canyon de Chelly, Rocky Mountain, and Great Smoky Mountains. Authorizations have been negotiated as a result of the prospectus for Great Smoky Mountains and Glacier Basin saddle livery at Rocky Mountain, and offers have resulted from the Lake Mead and Mount Rainier prospectuses.

Concessioners' Improvements

The Yosemite Park & Curry Co.'s new Village Store, restaurant and other structures, costing about \$800,000 were dedicated on May 1, and the new warehouse and utilities buildings were completed at a cost of about \$700,000. Degnan, Donohoe, Inc., also completed a new restaurant and delicatessen at an approximate cost of \$750,000. Completion of these structures allowed removal of the Old Village building complex and restoration of the area to its natural condition. In addition, concessioner improvement programs were completed at Big Bend, Crater Lake, Bryce Canyon, Everglades, Glacier, Grand Canyon, Grand Teton, Hot Springs, Mammoth Cave, Mount McKinley, Sequoia, Shenandoah, and Yellowstone National Parks; Black Canyon of the Gunnison, Canyon de Chelly, Death Valley, and Petrified Forest National Monuments; Blue Ridge Parkway; Cape Hatteras National Seashore; Lake Mead National Recreation Area;

and National Capital Parks, with investments totaling approximately \$2,500,000.

Other Concession Activities

Because of widespread opposition to the plan to remove concession facilities from the East Side of Rocky Mountain National Park, a study was made resulting in recommendations, approved by the Assistant Secretary, that certain facilities be retained.

A committee consisting of representatives from each Regional Office, and a concessioner and park employee from each Region, has been established to study the Service souvenir policy.

An arrangement was completed with the Eastern National Park and Monument Association for the operation of the Jamestown Passhouse interpretive exhibit through a joint cooperative agreement.

Land Acquisition

During the year \$2,400,000 was made available for land acquisition, of which \$900,000 was donated. Some 78,816.98 acres of inholdings were acquired by purchase, donation, transfer or exchange.

Donations of land included: 4,000 acres from the State of North Carolina for Cape Hatteras National Seashore; 2,040 acres from the State of Alabama and the Alabama Power Co. to comprise the Horseshoe Bend National Military Park, Ala.; and the Grant's Tomb site of 0.76 acres from the city of New York and the Tomb structure from the Grant Monument Association to comprise the General Grant National Memorial, established on May 1, 1959.

The Minute Man National Historic Site, designated as such by Secretarial order, April 14, 1959, comprises 8.08 acres of U.S. land transferred from the Laurence G. Hanscom Air Force Base.

Completed purchases and approved options cover some 7,155 acres in Glacier, Grand Teton, Lassen Volcanic, Rocky Mountain, Virgin Islands, and Yosemite National Parks; Badlands, Effigy Mounds, Joshua Tree, Muir Woods, Petrified Forest, and Whitman National Monuments; Fredericksburg, Gettysburg, and Shiloh National Military Parks; Independence National Historical Park; Cape Hatteras National Seashore; and Theodore Roosevelt National Memorial Park.

At Everglades National Park, the United States conveyed 51,000 acres of land and water to the State of Florida and received in exchange 100,741 acres, a net addition of 49,741 acres of land.

Water Resources and Water Rights

Two regional units were established, thus giving four of the regional offices basic water resources and water rights organization for operation under delegated authority. The Department's Geological Survey investigated water resources in 16 parks and monuments to find ground water supplies or define water rights. Three similar investigations were made under contracts. Two parcels of land were purchased with wells or well sites, and 70 exploratory and wells were drilled. Two water rights were licensed, approximately 25 extensions of time in which to make proof were obtained, public hearings were held on two water right cases. Surveys and analyses were continued to obtain water right data for appropriate water claims.

Design and Construction

In fiscal 1959, \$43,682,832 were available for the construction programs of the National Park Service, including carry-over balance from fiscal 1958. By June 30, 85.8 percent of these funds had been obligated, and four hundred twenty-one individual construction contracts were awarded. A large number of day-labor projects also were completed. To help offset the shortage of design office personnel, a number of contracts for professional architectural and engineering services were consummated.

Roads and Trails

Major road projects completed during the fiscal year amounted to 117 miles of reconstruction or new construction at a cost of \$8,151,000. Projects totaling \$5,852,560 were started during the year and an additional \$8,635,000 was obligated prior to the start of the fiscal year under advance contract authorization. This \$14,487,560 in new projects added to the \$5,008,000 of previous years projects which are approaching completion gives a total of work under construction of \$19,495,560.

Completion of the final stages on three park routes—the Jamestown Tour Road of 4.6 miles in Colonial National Historical Park, the Heart O'Hills Road of 6 miles in Olympic National Park and the 9.2 mile entrance road at Arches National Monument—opened 22 miles of new roadway to the public. Reconstruction projects covering 227 miles of roadway and bridges were also completed.

The major projects placed under contract during the year were Construction of the Thornton Gap Interchange and approaches at Shenandoah National Park; reconstruction of 1.679 miles of Uni-



The ever-increasing number of visitors often taxes campgrounds beyond their capacity. The "No Vacancy" sign directs campers to other sites in the area where they may pitch their tents. Mission 66 is designed to alleviate congestion caused by years of earlier park neglect.

venue at Vicksburg National Military Park; 6.5 miles of the Entrance Road at Mesa Verde National Park, 13.7 miles of paving on the Lassen Peak Highway at Lassen Volcanic National Park; 12 miles of reconstruction on the South Entrance Road at Zion National Park; 4,198 miles of reconstruction on the Jackson Lake Road at Grand Teton National Park; and the construction of grade separations on 14th Street and the Mall in the National Capital Parks in Washington, D.C.

Minor roads and trails projects totaling approximately \$4,500,000 have started. A few of the larger projects under contract for construction are the Bodie Island Entrance Road at Cape Hatteras National Seashore Recreational Area, amounting to \$377,179; a grade separation, structure and connecting roads, amounting to \$3,275, at Cumberland Gap National Historical Park, a parking area for the new Visitor Center, in the amount of \$155,668 and the Tur Loop Road amounting to \$260,690 at Saratoga National Historical Park.

During fiscal 1959, approximately 120 projects were under contract for minor roads and trails. An additional 5,300 vehicle parking spaces were gained during the year.

Parkways

The 1959 fiscal year again saw the National Parkways continue at a high rate of construction on the Blue Ridge Nat

Trace, Foothills and George Washington Memorial Parkways. The work was concentrated on closing gaps of Parkway construction and to provide additional visitor facilities along the completed sections. A \$16 million contract authorization was provided by the Federal Aid Highway Act of 1958, of which \$6,264,600 was programmed to Blue Ridge Parkway in North Carolina and Virginia; \$1,000,000 Foothills Parkway in Tennessee; \$2,858,600 for George Washington Memorial Parkway in Virginia and Maryland; \$5,260,300 Natchez Trace Parkway in Alabama, Mississippi, and Tennessee; \$216,500 for Rock Creek and Potomac Parkway in the District of Columbia and \$400,000 for advance planning.

The third year of Mission 66 also saw the largest number of project completions of major work since the National Parkways program was initiated in 1933. This represented 33 individual major projects with a total value of approximately \$15,000,000 including 42 miles of paving, 59 miles of repaving, 39 miles of grading and base course, 31 bridges and grade separations, tunnel lining and extensions, slope stabilization and guardwalls.

Two outstanding projects completed included an 11-mile section of the Blue Ridge Parkway in North Carolina extending southeastward from Wolf Laurel Gap through the Cherokee Indian Reservation into Great Smoky Mountains National Park, which marks the southern entrance to the Parkway, and a 4-mile section of the northbound lane of the Gatlinburg Spur along the west side of the West Fork Little Pigeon River of the Foothills Parkway.

Completion under the minor roads, buildings and utilities Parkway program included the Peaks of Otter, Va., information center on the Blue Ridge Parkway, numerous public service features on the Blue Ridge and Natchez Trace Parkways such as additional picnic ground facilities, campground roads, trails, comfort stations, maintenance buildings and utility systems and several employee residences.

As of June 30, 45 major contracts totaling approximately \$24,800,000 were in process under the Bureau of Public Roads program, including 68 miles of paving, 97 miles of grading and base course, 52 bridges and grade separations, and other work.

Under the authority of the Federal-Aid Highway Act of 1958 field studies were carried out jointly by the Bureau of Public Roads and National Park Service in Louisiana on the location of the Great River Road. Thus far, nine of the ten Mississippi River States have been furnished advisory services.

Buildings

The building construction program continued with emphasis on providing visitor facilities in the National Parks and Monuments.



There is no finer recreational and educational activity than camping in the great outdoors. Mission 66 is adding new camping grounds to the National Park System.

Visitor Centers, important to interpretation of the parks, were completed or were under construction at Abraham Lincoln, Hopewell Village, Pipestone, Moores Creek, Badlands, Mammoth Cave, Theodore Roosevelt, Bryce Canyon, Moose, Grand Teton; Fort Union, Zen, Cumberland Gap, George Washington Carver, Wright Brothers, Parachute Key, Everglades; Death Valley, and Great Smoky Mountains. Plans are nearing completion for Visitor Centers and administration buildings at Gettysburg, Fort Donelson, and Mound City Group.

The progress in the restoration of historic buildings is best exemplified in the Independence National Historical Park where Congress Hall, in Carpenters Court, has been reconstructed and the Merchants Exchange Building, one of the historic buildings designated to be restored and retained, has been rehabilitated to provide offices for Region Five and the Eastern Office, Division of Design and Construction. The last major demolition contract for removing non-historic buildings has been awarded with completion scheduled for late this fall.

Emergency measures were taken to protect Congress Hall in Independence Square from threatened collapse following damages sustained in the heavy snows of the previous year.

A total of 406 miscellaneous buildings were rehabilitated or constructed at a cost of \$9,700,000.

The housing situation in parks and monuments was further improved by the provision of 107 permanent and 75 seasonal units programmed during the 1959 fiscal year.

An agreement was reached with the city of St. Louis and the Terminal Railroad for the relocation of the elevated railroad tracks between the Memorial and the Mississippi River levee at Jefferson National Expansion Memorial in St. Louis and a contract was awarded in the amount of \$2,421,000 for this work. The development cost for this project is shared by the city of St. Louis and other contributed funds in the ratio of \$1 of non-Federal for each \$3 of Federal funds. The present schedule of construction is predicated upon completion of the entire project, estimated to total \$22,500,000, in time for the proposed sesquicentennial celebration in 1963.

New impetus was given to the Historic American Buildings Survey in its second year of resumed recording activity. A unit was established in the Western Office, Division of Design and Construction, in San Francisco, and in collaboration with the University of California produced measured drawings and photo-data books of a number of historically important structures in California. The unit will continue during the present year with the assistance of a supervisor and a student measuring team.

A supplement to the Catalog of the Measured Drawings and Photographs in the Library of Congress, listing and describing material added to the collection since March 1, 1941, was compiled and published. The Specifications for the Measurement and Recording of Historic American Buildings and Structural Remains was revised and distributed.

The Building Construction Handbook was completed, printed and distributed to the field. This handbook prescribes regulations governing the planning, location, construction, alteration, repair, moving and demolition of buildings in the National Park System.

Utilities and Miscellaneous Structures

The Service is continuing the progress of improving utilities and miscellaneous structures as reflected in the following general statistics:

There were approximately 677 additional campsites in 25 campgrounds, this included newly developed campgrounds and additions to existing ones. There were 90 water systems and 76 sewage systems completed. These projects increase water storage facilities by 3,400,000 gallons, all representing a capital investment of approximately \$2,705,000.

Master Plans

Emphasis is continuing on the preparation of Master Plan drawings on a schedule which will assure thorough studies of development needs in relation to current and future management requirements well in advance of the establishment of firm programs. Over 100 preliminary and final Master Plan drawings were prepared.

An important step was taken toward the integration of the Mission 66 Prospectus and other planning documents into the Master Plan. In its new format, the Master Plan will become a more effective instrument in establishing and defining the broad objectives, policies, and requirements for all elements of the park program.

Office of Audits

Of major importance during the year was a comprehensive study of the Service's audit policies and practices which was conducted by a Departmental committee. Following recommendations of this committee, the audit scope has been changed to place primary emphasis on accounting and financial matters rather than management aspects. Other recommendations dealt with improving the effectiveness of report distribution and taking follow-up action by administrative officials.

During the year more than 40 reports were issued, eliminating a backlog on hand at the year's start. To comply with the survey recommendations will entail a 2 to 3-year audit cycle. Experience under the new program shows an urgent need for additional auditors to achieve this goal.

National Capital Parks

An Employee Relations and Training Officer was hired in August 1958. Training courses for maintenance, United States Park Police and history section personnel were conducted. There was created in November 1958 a Board of United States Civil Service Examiners to hold competitive examinations for positions peculiar to this office.

Visitor Services

Intensive use of the parks continues creating heavy demands on personnel and park facilities. An estimated 45 million persons used the facilities and services provided by the National Parks; more than 5 million visitors were counted at the first

national memorials; there were 267 special events attended by over 2 million persons; park naturalists and historians served approximately 300,000 people, and nearly 6 million listened to interpretive recordings or participated in self-guided tours.

Protection

Criminal complaints handled by the United States Park Police increased about 8.5 percent and noncriminal complaints were up nearly 25 percent over fiscal year 1958. Some 1,500 traffic warning tickets were issued and there were upwards of 25,000 arrests and citations involving adults. In the Semi-annual Firearms Qualification Program, 99 percent of the Force qualified for medal awards. The recently announced Promotion Competition Program was received with enthusiasm and steps have been taken to put it into effect.

Physical Improvements

Some 200 plans relating to developments were prepared and nearly \$4 million were expended on about 60 contracts. Much time was spent in analyzing highway plans of other agencies, e.g. approaches to Potomac bridges, the Inner Loop and the Glover Archbold Parkway, and in preparing proposals to minimize their impact on the parks. Horticultural activities included planting of thousands of trees and shrubs, salvaging of top soil, and improving neighborhood parks. Major construction included two stables, several bridges, road realignment and paving in Rock Creek Park, reroofing of Lincoln Memorial; rehabilitation of the Washington Monument elevator; repairs and stabilization at Fort Washington, Custis-Lee Mansion and the Old Stone House; and extension of the George Washington Memorial Parkway.

Research and Planning

Contracts have been let for the construction of the Rock Creek Nature Center, for continuance of grading and surfacing of portions of the George Washington Memorial Parkway in Maryland and Virginia, and structures at Prince William Forest and Catoctin Mountain Parks. Historical research has been conducted at Fort Washington, Custis-Lee Mansion, House Where Lincoln Died, and the Old Stone House. Studies were made on a land acquisition problem at Great Falls and for extension of the George Washington Memorial Parkway to Woodlawn and beyond. Development plans are under way for a mechanical maintenance shop headquarters, and a park operations building.

Office of Territories

Anthony T. Lausi, *Director*



THE FISCAL YEAR ended June 30, 1959, was one of major accomplishment from the standpoint of the basic objectives of the Department of the Interior and its Office of Territories in fostering social, economic and political development in the territorial possessions of the United States. The outstanding political achievement of the year was the attainment of Statehood by the Territories of Alaska and Hawaii.

On July 7, 1958, the President of the United States approved the Alaska Statehood Act, thus ending a more than 40 year effort to gain full self-government for that Territory. On completion of the necessary procedural steps, Alaska was formally admitted as a State by Presidential proclamation on January 3, 1959.

Less than 3 months later, the Congress acted favorably on Statehood legislation for Hawaii and the President approved the Hawaiian Statehood Act on March 18, 1959. This action culminated 5 years of effort on the part of the people of Hawaii to become a free and equal member of the American Union. Their intense desire for Statehood became abundantly clear when the voters on June 27, 1959, endorsed Statehood by the overwhelming majority of 17 to 1.

Shortly after the close of the fiscal year, Hawaii became the 50th State of the Union by Presidential proclamation on August 21, 1959.

In the remaining territories, the Virgin Islands, Guam, and American Samoa, and in the Trust Territory of the Pacific Islands there are found widely differing stages of social, economic and political development. In each area, paying due regard to local customs and aspirations, it is the policy of the Office of Territories to assist and encourage the people in economic betterment and the growth of self-government.

During the past year, most areas registered increased growth in business and commercial activity despite some severe weather.

reverses. In American Samoa, a hurricane caused widespread damage in the Manu'a island group and destroyed coconut plantations and other crops essential for cash income or subsistence. Prompt and strenuous efforts were required to alleviate suffering and to begin restoration of crops, dwellings, and other facilities.

The economy of the Trust Territory of the Pacific Islands showed the effects of the disastrous hurricanes of the previous year. Agricultural emphasis in the devastated atolls was placed on replanting coconut groves with improved seed in a manner designed to insure maximum future yields. Copra is the major cash crop of the Trust Territory although programs of agricultural diversification are under way.

In the Virgin Islands, a serious water problem will be met by the construction of a salt-water distillation plant to be built and operated by the Virgin Islands Corporation. As a byproduct of the distillation process, electric energy will be generated to meet the growing power needs of the island of St. Thomas.

In the field of government, the most dramatic progress has occurred in the Trust Territory. In this far-flung territory emphasis is placed on the local level. During fiscal year 1958 charters were issued to 20 municipalities while one island-governor received a charter as did an additional district congress. Increasing numbers of Micronesians are being placed in top positions in such diverse fields as education, finance, public health, and judiciary.

Hawaii

Although other events in Hawaii were overshadowed by Statehood and preparations for the transition to Statehood, fiscal year 1959 saw Hawaii experience unprecedented growth and prosperity. Significant advances were made in practically all fields.

The expansion of Hawaii's economy is clearly indicated in the revenues, appropriations, and expenditures of the Territorial government. As a result of new tax laws in 1957, the Territory ended the 1957-59 biennium with a surplus of \$14 million. The last session of the Territorial Legislature, meeting in the spring of 1959, appropriated a record-breaking total of \$227.6 million for the 1959-61 biennium, or \$59.2 million more than the 1957-59 appropriation. Even with this increase, it is anticipated that there will be a \$10 million surplus at the end of the 1959-61 biennium, despite slight reductions made in tax rates by the 1959 legislature.

Hawaii's economic base continued to broaden. Manufacturing, which nearly trebled since World War II, has been given further impetus.



Hawaii became a State in White House ceremonies on August 21, 1959. Speakers were the Vice President, the Speaker of the House, the Secretary of the Interior, Secretary of the Territory of Hawaii, and part of the Hawaiian Congressional Delegation.

The beginning of work on an oil refinery and a steel mill—both new industries to the islands. Diversified agriculture increased substantially, and the construction industry sustained the boom which has seen it rise from \$68 million in 1950 to an estimated \$100 million in 1959. Tourism continued to break all records with hotels and other facilities finding it difficult to keep pace with increasing demands. Sugar and pineapple production remain the long mainstays of the Hawaiian economy, however.

Politically, the past year was extremely active. In November 1958, the last territorial elections were held to elect a reapportioned legislature. This legislature, almost doubled in size, met in the spring of 1959. Passage of the Statehood Act in the middle of the session turned the political spotlight on the first State election.

Nevertheless, the last territorial legislative session was an active one. It provided for the transition to Statehood by creating a legislative interim committee to consider problems of reorganization. It passed one of the most liberal unemployment compensation laws in the country and extended complete coverage to cultural and government employees. It strengthened the administration of the courts through the establishment of an administrative office of the judiciary. It provided substantial salary



Statehood Celebration at Iolani Palace, Honolulu.

increases to government employees, teachers, and the faculty of the University of Hawaii. The legislature also adopted a comprehensive ground water control law based upon the Model Water Use Act. Finally, the 1959 Legislature took the first steps to realize Hawaii's destiny as a bridge between East and West by setting up Asian studies and overseas operations programs at the University of Hawaii.

The past year witnessed significant development of such basic facilities as highways, airports, and water projects. Highway expenditures exceeded the \$21.8 million record set in 1958. Major water developments have been advanced on all islands, including a 5-mile long tunnel on Molokai and the successful drilling of wells and construction of a distribution system at Kona on Hawaii. Also, Hawaii is entering the "jet age" with the building of a \$22 million airport at Honolulu, on which construction began this year. Enrollment of new students in the public schools is increasing at the rate of 4,000 per year, making necessary a more than \$60 million building program for the next 6 years.

Housing continues to be one of the major problems despite the construction of 7,839 units of Capehart military housing on Oahu at a cost of \$105 million. The shortage is due to high cost of land and construction, population increase, and the displacement of many families by large-scale Government construction programs. Nevertheless, much improvement is occurring.

Alaska

As in Hawaii, Statehood overshadowed all other events in Alaska during the fiscal year. Upon the approval of the Statehood Act of July 7, 1958, the necessary Statehood referendum and elections were promptly scheduled. With little public notice Territorial agencies and the Department of the Interior began to draft plans for prompt and efficient transition to State Government.

Enactment of Statehood legislation focused nationwide attention on Alaska. Economic development and growth of population, for several years on the increase, were accelerated. In spite of this increase, the economy had remained heavily one-sided and, except for the construction and rapidly expanding tourist industries, largely based upon extractive industries such as fishing and mining.

Little manufacturing took place in the Territory. The major exception was the pulp plant at Ketchikan to be followed by a second pulp plant at Sitka, scheduled to begin operations in the fall of 1959. Drilling for oil and gas, for the first time on an extensive scale,



In White House ceremonies attended by the Vice President, the Speaker of the House, the Secretary of the Interior, the Alaska Congressional Delegation, the last appointed Territorial Governor and the Acting Governor of the Territory, the President signs the Alaska Statehood Proclamation.

by major oil companies, continued and offers bright prospects to new industries in interior Alaska. Oil activities in Alaska were spurred by the negotiation of three oil development contracts which require oil companies to seek oil actively during the life of the contracts. Several private firms were engaged in developing export markets for Alaskan coal which hitherto had served only the local domestic market.

Amid enthusiasm and boom atmosphere, Alaska stands on the threshold of a new era of economic development. It is a challenge Alaskans have proven themselves well able to meet.

Guam

A new cement packaging plant and several commercial construction companies started operations on the Pacific island of Guam during fiscal year 1959. Retail sales, private and commercial building, bank clearances and tonnage receipts at the commercial port all have grown.

The Military on Guam awarded several local contracts for defense installations and also increased purchases from local farmers. The Department of Agriculture, in a program to improve the livestock strain, imported cattle and swine from the mainland. An economic survey was conducted for the Government of Guam by Stateside research institute.

To encourage increased political interest and participation in local government, a District Government Council was organized, composed of the 19 elected District Commissioners and three Assistant Commissioners. The Council was created to promote and improve efficiency in district and village governmental operations and to provide a medium for closer relationship and understanding between the executive branch and the people of Guam.

A general election was held in November 1958 for members of the 5th Guam Legislature. Among the major laws enacted by the legislature were authority for the Territorial Planning Commission to undertake urban planning and to accept grants from the Federal Government; an act for uniform reciprocal enforcement of family support; scholarships and student loans; a financial responsibility law for automobile owners; and amendments to the law relating to applications for commercial and services licenses. The Legislature also took action with respect to the pay schedule of ungraded government employees. Two bills were vetoed by the Governor, one pertaining to the tenure of officials requiring confirmation of the Guam Legislature and the other relating to the Small Claims Court. The vetoes were sustained by the Legislature.

An appropriation was obtained for a study of personnel and management to pave the way for more efficient and economical operation of the government. The first increment of the Administration Building was nearly completed, a step toward discontinuing executive branch use of old temporary structures. Of direct importance to the people of Guam and business and commercial interests was completion of the translation of archaic Spanish land records and the award of a private contract for improvement of land title records. In the field of education, four new school buildings were opened and construction progressed on a new junior college building.

A more favorable situation in the collection of income taxes was reported by the Island's Department of Finance, largely because of an amendment to the Organic Act by the United States Congress. The office of the Auditor-General began operations. An actuarial study was completed for the Retirement Fund. In order to resolve problems arising from the operation of the Navy and Commercial Ports, a Seaport Advisory Board was established between the Government of Guam and the Navy.

American Samoa

Through developments in airport construction, air transportation, a greater influx of tourists and a general increase in economic activity, American Samoa continues to unfold its ancient culture and traditions to the eyes of the outside world.

Of prime importance to the future of the territory this year was the virtual completion of the engineering plans, specifications and cost estimates for the international jet airstrip at Tafua Airport. With funds already approved, construction will begin in July 1959.

A significant development in air transportation occurred when it became apparent at the close of the fiscal year that Samoan Airlines, Ltd., would begin operations in July 1959. Samoan-owned this airline will serve to link the island territories and help make the South Pacific area a more closely integrated regional entity.

In anticipation of further increases in air traffic, including flights of larger and heavier piston-powered aircraft, a 100-foot asphalt strip covering the entire length of the existing 6,000-foot Tafua airfield was begun with paving completed shortly after the end of the fiscal year.

The first increment of the new Administration building under construction at Agana, Guam.



A new \$79,000 Marine Railway was completed during the year. This was a major construction project and is expected to be an important element of economic development. Largest of its kind in the area, it will serve an important need in the maintenance and servicing of vessels up to 350 tons.

Business and economic activity reached encouraging levels during the year. A new high was reflected in every department of the Territory of American Samoa. Deposits totaled \$1,934,933 at the close of the fiscal year, an increase of \$231,000 over the previous year. Actual Government receipts collected were \$858,141 compared to \$2,980 last year. Exports totaled \$7,605,701 as compared to \$34,258 for the previous year.

In February 1959 the island group of Manu'a suffered great destruction from one of the most severe hurricanes on record. Hundreds of houses were destroyed or suffered major damage and the majority of the coconut plantations and other cash and subsistence crops were wiped out.

Manu'a was immediately declared a disaster area by the Governor and a central relief committee established. Credit goes to the leadership of the chiefs in local government, the local Department of Agriculture, and to the courage and initiative of the people in rebuilding destroyed homes and replanting crops. The United States Department of Agriculture furnished prompt relief in the form of surplus tools and generous donations were received from private sources, churches, and from the people of Western Samoa.

A highlight during the year was the successful South Pacific Tuberculosis Conference held in American Samoa in November 1958 and attended by 30 professional medical and public health workers and specialists from many countries.

In April and May 1959 American Samoa was represented by a delegation of five Samoans at the Fourth South Pacific Conference of the South Pacific Commission held in Rabaul, Territory of New Guinea. Excellent reports were received of the contribution made by these delegates.

Vigorous efforts were made during the year in the field of youth development and youth fitness. Organized athletic programs and inter-village competition were carried out in the schools and villages. To help carry on this work in cooperation with the Youth Development Officer, a Samoan Recreation Program Supervisor was appointed from Honolulu.

Trust Territory of the Pacific Islands

A United Nations Visiting Mission made a month's tour of the Trust Territory of the Pacific Islands, a strategic trusteeship administered by the United States through a High Commissioner functioning under the Department of the Interior. Members of the Mission conferred with representative Micronesian leaders of the districts and examined all aspects of the operation.

At the close of the fiscal year the United Nations Trusteeship Council began its annual examination of the Trust Territory administration.

Micronesian employees of the Trust Territory Government were promoted into administrative positions as they became prepared through education and experience to fill the posts. Three additional Micronesians advanced to the top health offices in their respective districts, making a total of five serving as district public health administrators. Others were placed in responsible positions in such fields as education, finance and judiciary.

An in-service program of vocational training was inaugurated with two groups of Micronesian employees in trades categories brought to the Trust Territory shops at Guam for instruction. Similar programs for other types of administrative work are scheduled for the coming year. Supervisory development courses were conducted at headquarters and in the districts over 20-week periods with 185 employees participating.

With the chartering of an additional district-wide congress and one island-group congress, and of 20 municipalities, plus the conversion of a bicameral congress to a unicameral body, progress in political development was well ahead of the target dates set.

Agriculture and fishing continued to be major elements in the economic development of the islands. An overall program was carried out for rehabilitation of the communities affected by the destructive typhoons of 1957 and 1958. Agricultural specialists were detailed to the more seriously damaged atolls to provide assistance. The large-scale planting of new coconut groves by scientific methods is expected to prove of long-lasting benefit to the islands and their inhabitants; over 220,000 selected seed coconuts were shipped from Yap District for planting in other districts. Decrease in copra production from that of the previous year, a result of typhoon devastation, was partially compensated by increased copra prices.

Cacao development was strengthened by designation of a specialist to oversee the program; the first course in cacao cultivation to be held in the Trust Territory was inaugurated, with selected trainees participating. New marketing arrangements, and improved



ed coconuts at Yap, ready for distribution to other districts of the Trust territory.

pping facilities, brought increased produce sales. Further development of agricultural centers for propagation and distribution purposes; cultivation of subsistence and economic crops, livestock and poultry; soil conservation and improvement, and timber production are other aspects of the agricultural program. Under direction of staff entomologist, efforts were continued toward the control and eradication of agricultural pests.

Although trochus, second most important export item of the Trust territory, has met a setback in the world market due to competition from plastics for buttons, substantial amounts of the shells were harvested and sold during the year, and the establishment of sanctuaries for conservation purposes was continued.

A commercial fishing project was developed in Palau District under administrative organization and direction. A boat especially designed for the purpose was procured, provisions for icing and storage made, and the fishing operation begun. Future plans call for establishment of a small-scale fish-canning plant, and inauguration of similar commercial fishing projects in some of the other districts.

In each district, one or more chartered trading companies attended the needs of the inhabitants and purchased local products. Assets of the nine companies, all Micronesian owned, stood at \$100,000.

proximately \$2,000,000. Other private concerns were in operation in all districts.

Transportation, always a major problem in the Trust Territory area of approximately 2,000 small islands set in some 3,000 square miles of ocean, was put on a regular basis with the establishment of a firm sailing schedule for the chief supply vessels. Arrival and use of the newly constructed M/V *Kaselehla*, designed for Trust Territory needs, eased the tight shipping situation to some extent. Flights by air, using three amphibious SA-16 planes, were made on a weekly schedule to the major districts, transporting personnel, mail and priority cargo.

Among major construction programs was the new Pacific Islands Central School at Ponape, including classrooms, administrative building, auditorium, cafeteria, dormitories and faculty housing. A dock and harbor rehabilitation project at Truk was getting under way as the fiscal year ended. Local labor is being utilized in all government construction, providing new skills for Micronesian workers and increasing their purchasing potential.

Grants-in-aid for new elementary schools were provided by the Trust Territory Government, with eight schools under a joint grant-and-local-fund program, and plans for others made and approved. Teacher trainers supervised the Micronesian teachers of elementary schools, both in the field and through teacher institutes and summer sessions. One new public intermediate school was opened, and plans for plants or additions to present intermediate school structures are planned for all districts. Intermediate schools and high schools under mission sponsorship augmented the training provided by the public intermediate schools and at the Pacific Islands Central School.

Increased emphasis was placed upon college scholarships. Forty-eight students were studying abroad on Trust Territory Government scholarships, and eight grants were made for studies leading to college degrees.

The School of Nursing continued its training of nurses for the public health staffs of the districts. Refresher courses for medical practitioners, and training programs for laboratory technicians, dental practitioners, health aides and nurse aides continued to be given in the district hospitals, and in hospitals at Guam and Hawaii. A 6-week Health Education course in which 39 Trust Territory personnel participated, was held at Guam under combined auspices of the Trust Territory Government, the U.S. Navy-Saipan District Administration, and World Health Organization. Pilot field health projects were conducted in various districts.

Virgin Islands

On September 25, 1958, the Honorable John David Merwin was sworn in as the first native-born Governor of the Virgin Islands, succeeding the Honorable Walter A. Gordon who was appointed Judge of the U.S. District Court for the Virgin Islands. At the same time, the Honorable Roy Williston Borne, also a native-born Virgin Islander, was sworn in as Government Secretary, replacing Mr. Merwin.

The Government of the Virgin Islands continued to progress both in organization and in fiscal affairs during fiscal year 1959. Under the Office of the Government Secretary, funds have been appropriated and a contract made for the development during the next years, with the aid of skilled consultants, of a modern tax assessment program.

Total revenues collected during the fiscal year amounted to \$224,156.95—the highest in the history of the territory. This represented an increase of 25.5 percent over the revenues of the preceding fiscal year.

Outstanding activities of the Department of Tourism and Trade were the establishment of an office in Puerto Rico and a public relations office in New York City to handle tourist promotion and general publicity. It is estimated that 150,000 visitors came to the Virgin Islands and spent approximately \$18,000,000. Eighty-eight cruise ship visits during the year again broke all records.

The greatest achievement in the field of public works during the year was the awarding of a \$1,302,585 contract for the reconstruction of the Alexander Hamilton Airport in St. Croix.

With the steady increase in the number of residents and visitors to the islands, and with only a total annual rainfall of 33.69 inches, the greatest problem continued to be the water supply. In order to satisfy needs on St. Thomas, the Government tug and barge, supplemented by chartered equipment, made 230 trips to Puerto Rico bringing in a total of 49,665,800 gallons of water—10,000,000 gallons more than in the preceding fiscal year.

Under the Department of Education, two new modern school buildings in St. Croix with a total of 30 classrooms were dedicated. The old elementary school was reopened. In St. Thomas, renovations to existing facilities and the addition of two new buildings with 10 classrooms were completed. Rehabilitation was commenced on the headquarters building of the Department of Education.

In the Department of Health, plans were initiated to provide for the construction of out-patient, laboratory and office facilities at the Charles Harwood Memorial Hospital in Christiansted.

The Department of Social Welfare was assigned a new program providing emergency housing for displaced families and construction began on a model unit. The 1958 congressional amendments to the Social Security Act enabled the Department to increase grant to the public assistance case load of 1,600 by approximately \$37 per case.

In the field of public safety, police strength has been increased. A team of traffic engineers, loaned by the Commonwealth of Puerto Rico, surveyed traffic conditions and suggested a series of improvements.

Under the Department of Agriculture and Labor food production program several thousand vegetable slips were supplied to farmers. The vegetables harvested from this program were distributed to public institutions as a needed dietary supplement. The Department continued its technical and other service programs for farmers.

In the Department of Property and Procurement, an economist from the Commonwealth of Puerto Rico made an excellent report on the subject of containing the spiralling prices of foodstuffs in the Virgin Islands. The report will be the guidepost for action in the coming fiscal year.

Virgin Islands Corporation

The Virgin Islands Corporation was extended until June 30, 1959 under Public Law 85-913, approved September 2, 1958.

The major change in the act extending the Corporation was provision authorizing the Corporation to operate and maintain salt water distillation facilities in St. Thomas, Virgin Islands. The proposed plant will supply water for sale to the Government of the Virgin Islands and, as an integral part of the installation, the power facilities of the Corporation will be increased by the addition of 2,500 kilowatts steam turbine. Engineering studies for the plant are under way.

The principal activities of the Corporation continued to be the production of sugar and the generation and distribution of electric power. The production of sugar was more than double that of the previous year. A total of 116,447 tons of sugarcane were grown and 12,543 tons of sugar, raw value, were manufactured, as compared to less than 6,000 tons last year. The production of sugarcane by the Corporation showed a profit of \$85,350.88 for the year.

An engine explosion seriously hampered sugarcane milling operations and the factory operated at reduced capacity with considerably lessened efficiency. The manufacture of sugar showed a loss of

2,139.31. As a result of the explosion, approval was given by the Board of Directors and by the committees of Congress to invest \$10,000 in mills and steam turbine equipment. The new equipment is expected to be in operation for the 1960 crop.

The Power Department in St. Thomas suffered a financial loss for the first time since this operation was taken over by the Corporation in 1952. A series of engine and generator breakdowns, together with a sizeable accidental loss of fuel oil, resulted in an overall loss of \$119,070.99. The substantial increase in power consumption, limited generating capacity, and the need for operating equipment to the limit of its output, contributed to the serious breakdowns experienced. This problem will be alleviated by the installation of a new 2,500 kilowatt engine expected to be on the island in the fall of 1959. In spite of the difficulties the peak power production on St. Thomas increased 9.8 percent over the previous year and the number of consumers increased from 4,586 to 4,860.

Power operations in St. Croix showed a profit of \$17,201.85. There was an increase of 9.7 percent in power load over the previous year. The total number of consumers on St. Croix increased from 3,787 in 1958 to 3,988 in 1959.

The Corporation continued to carry out various agricultural programs under grants from the Congress. The construction of earth dams on the Islands was continued. Seven dams on St. Thomas and St. Croix with an estimated holding capacity of 6,991,380 gallons were constructed and one older dam was reworked. The dams are important to agriculture and have proved of great value in view of the acute water shortage.

A total of 523 acres of brush land were cleared making a total of 1,003 acres cleared under the land clearance program since 1952. The program was discontinued as of June 30 since most of the more valuable land for pasture and cultivation, owned by small farmers, has been cleared.

The forestry program was primarily concerned with the establishment of permanent forest cover without encroaching upon the needs of other aspects of proper land use. Substantial plantings of Dominican mahogany and teak were established on Government and private lands. A program for the improvement of natural forests was initiated. A utilization program providing sawmill facilities was in operation and provided lumber for local industry.

The Corporation continued to manage the Navy properties on St. Thomas for the Secretary of the Interior. The income derived from these properties has more than doubled since 1900 and now exceeds \$250,000 per year. The income is used to provide funds for maintenance and improvements of the properties.

ties. During the latter part of the year the airport runway and part of the terminal building were turned over to the Virgin Islands Government.

The Alaska Railroad

Gross income for the year amounted to \$13,482,545.96. After deducting expenses of \$13,138,744.79, net income of \$343,801.17 is reported. This represented an increase of \$234,784.55 over preceding year.

Improved service to patrons was made possible through expansion of unitized cargo facilities. Special authority was obtained from Congress for the procurement of 160 unit rail boxes and auxiliary equipment. About half of the units were received prior to the close of the fiscal year and the balance will be placed in service early in fiscal year 1960.

During the fiscal year the Railroad completed engineering studies with equipment firms and began installation of an electric travel bridge gantry of unique design to facilitate the rapid transfer of unit rail boxes from rail flat cars to highway trucks and vice versa. This equipment will not only serve the unit rail box program, but will substantially up-grade the present "piggy back" service being offered to motor freight carriers.

Construction of a modern passenger station at Fairbanks is being undertaken with completion expected during fiscal year 1960. This will replace a structure erected in 1923.



Unit Rail Boxes of The Alaska Railroad improve and speed service

The renewals and ballasting of the remaining portion of the main line between Broad Pass and McKinley Park were completed. This project was begun in the preceding year.

A project of replacing ties and ballasting with crushed gravel on a stretch of roadway extending a distance of approximately 30 miles north from Healy was approximately 30 percent complete at the end of the year. The work is being accomplished by force account, furnishing employment to some 65 natives.

The Railroad constructed more than two and one-half miles of spurs and sidings, and completed survey work for a main line enge of approximately 7 miles in connection with the military project at Clear. In the coming year about 7 miles of new main track will be turned over to the Railroad by the military, and the Railroad will transfer about 5 miles of existing main line to the military in connection with the Clear project.

Among the projects scheduled for fiscal year 1960 are the completion of new section houses at Garner and Eielson, elimination of 10 t heaves on about $3\frac{1}{2}$ miles of roadway at various locations, and modernization of approximately 15 miles of track.

Alaska Public Works

In 1949, by Public Law 264, the 81st Congress authorized a \$70 million program of public works in Alaska to foster economic and social development through provision of facilities for community

This 5-year act was later extended by Congress to June 30, 1954. Under this program the Federal Government, upon application by a public body, such as the Territory, a city, a school or utility district, finances the entire cost of construction of approved projects and upon their completion, transfers them to the public bodies for which they were built at prices that will return to the Treasury of the United States not less than 50 percent of the total cost.

In providing basic community facilities and other essential public works, the program has made a major contribution to the development of Alaska.

Through June 30, 1959, congressional appropriations totaling \$6,076,200 have become available. Allotments have been made in an amount of \$69,888,280 to 172 projects, to provide 61 school units, 3 hospitals and health centers, 8 municipal buildings, 50 sewer and water projects, 27 other projects including streets, utilities, and small boat harbors, and 22 units for emergency relief with a value of \$436,400. Of these, 145 projects valued at \$54,580,356 are completed. Another 12 projects estimated to cost \$6,235,896 are under

tially complete and in use, and 15 with an estimated value \$9,072,028 are in the construction stage. During the year planning was completed on 18 project units and contracts awarded. All are scheduled to be under construction during the 1959 season, with final completion of all units in 1961. However, strikes of skill workers under way on June 30 were delaying progress and, if continued, will seriously delay the completion of the units affected.

Office of the Assistant Secretary Fish and Wildlife

W. S. Leffler, *Assistant Secretary*



THE ASSISTANT SECRETARY for Fish and Wildlife discharges the duties of the Secretary of the Interior with respect to the Department's programs in the field of fish and wildlife. He is responsible for secretarial direction of the Fish and Wildlife Service and its constituent bureaus.

Legislatively, the year ending June 30, 1959, was an especially important period for the Department's Fish and Wildlife Service. Alaska Statehood, amendments to the Wildlife Coordination Act, passage of the \$3 duck stamp law and provision for a long range study of the effect of pesticides upon fish and wildlife were important legislative actions which related to the work of the Service.

There were numerous important developments in the nonlegislative field in international and national fisheries, waterfowl management and research on commercial and recreational fish and mammals.

The Alaska Statehood Act and subsequent events provide for ending more than half a century of Federal management of Alaska's fish and wildlife resources. As fiscal 1959 drew to a close it seemed apparent that on January 1, 1960, Alaska would have complete responsibility for its sport fish and game resources and for the commercially important salmon fishery. The Federal Government will continue jurisdiction over the Pribilof Island seal herd and over the sea mammals. The Government will also continue its research responsibilities on salmon and other species of fish and wildlife. The interim period between the passage of the Statehood Act and the time when the new State will actually assume its full responsibilities will be used as a transition period with the Service rendering all assistance.

to personnel of the new State who are soon to take over full responsibility.

The amendments to the Wildlife Coordination Act give greater recognition to fish and wildlife resources in the planning and execution of Federal projects in which fish and wildlife are affected. Steps are being taken to implement the intent of the amended act in cooperation with other Federal agencies. The States and the Fish and Wildlife Service of the Department of the Interior have a better opportunity now to stimulate the sound conservation of fish and wildlife than at any time in our history.

Legislation permitting Federal cost-sharing in fish and wildlife developments on Watershed Protection and Flood Control projects also opens new opportunities for the enhancement of fish and wildlife resources on those projects.

The \$3 duck stamp law—widely supported by sportsmen—is considered by many to be one of the most important pieces of legislation for waterfowl in the past quarter century. Briefly, it raises the cost of a Federal duck stamp from \$2 to \$3 and provides that all of the money so raised except a small proportion actually used in the printing and distribution of the stamps shall be used for the selection and acquisition of waterfowl habitat. This means that funds for the development and maintenance of waterfowl habitat and for the enforcement of Federal waterfowl regulations must come from some other source after the end of fiscal 1960.

In the commercial fishery field the international phase was more pronounced than usual in fiscal 1959. The Department of the Interior took steps with the Department of State to expand the foreign reporting program in the interest of eventually obtaining world-wide coverage of foreign fishery developments of interest to the American fishing industry. Both Russia and Japan established large scale fishing operations in the waters west of Alaska, Russian boats entered the fishery in the northwest Atlantic and Japan extended its fishing activity to various other parts of the world.

Increased interest in the ocean as a source of food is noted in the activities of other nations. In many instances, more fishing vessels are being put to sea and in practically all instances there is considerable improvement in the design of new fishing vessels.

There is growing interest in the development of shrimp beds where Fish and Wildlife Service explorations discovered off the northern coast of South America. The African coast is beckoning to many fishing firms including Americans. Explorations in the Gulf Stream off the Atlantic coast have opened up the possibilities of a new fishery there too.

The general field of oceanography is coming in for considerable study. Never in history has there been as much scientific interest shown in this area as is evidenced now. It would appear that men of all nations are suddenly realizing the possibilities of the ocean as a source of supply for many things and the realization that the ocean is something more than just a body of water between land masses. Long range plans are under way, and research plans are being coordinated throughout the Federal Government. This means that when large-scale scientific study of the ocean begins it will be coordinated governmental action.

In general, the Department's Fish and Wildlife Service is taking those steps necessary to develop resources capable of withstanding the pressures of the future. A recommendation was made by the Secretary of the Interior to halt further dam planning and construction in the middle Snake River until the effectiveness of fishery studies could be given further study.

A committee of the Service and the Columbia Basin Interagency Committee recommended that emphasis on the Columbia River salmon program be placed on stream improvement and further fishery construction be halted until the effectiveness of the present fishery program could be ascertained.

Equally as steadily more effective too is the partnership effort of State and Federal agencies to plan and act to meet future needs of the ducks and geese. The idea of Continental control of migratory waterfowl is growing. There is greater public appreciation now of the valuable results of research. It is playing a more important part in the conservation of offshore fisheries and it is becoming more and more a valuable tool in the management of recreational resources generally.

Fish and Wildlife Service

Arnie J. Suomela, *Commissioner of Fish and Wildlife*



RESPONSIBILITY FOR COORDINATION of the activities of the two component bureaus of the Department of the Interior Fish and Wildlife Service rests with the Office of the Commissioner. In addition to general supervision and coordination activities, the Commissioner's Office operates in the fields of international relations, safety, program review, and information.

The component bureaus—the Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries—are operating with a considerable degree of decentralization and most of the operating responsibility is delegated to the regional level.

The reorganization of the Fish and Wildlife Service as completed by the Fish and Wildlife Act of 1956 was completed during the year when each bureau established its own administrative divisions to handle the "housekeeping" responsibilities.

Events during the past year continue to emphasize the fact that while each bureau has its own specialized field of operation there are many areas in which there is a common interest.

The pesticide research program affects the activities of both bureaus of the Service because a continuance of unthinking use of insecticides and herbicides not only threatens fish and wildlife in inland habitat but also endangers valuable commercial fisheries dependent upon the maintenance of proper coastal and estuarial conditions.

The sudden increase in the popularity of marine sport fishing, for example, points up the necessity for considerable more research if the needs of both sport fishermen and commercial fishermen are to be met.

The amended Wildlife Coordination Act not only gives recognition to the recreational resources but it gives the Service a basis

ance to bring important estuarine values to the attention of those planning Federal water projects.

Conservation work planned under the amended Coordination Act and under the amended Watershed Protection and Flood Control Act will be of primary importance to the recreational resources and will react to the benefit of commercial fisheries by reducing siltation, drying and water pollution. These advantages were evident under acts before amendment but will be much more evident now.

A Servicewide safety program has been organized and is already giving indications of its effectiveness. Direct benefits to operating programs are shown in reductions in days lost through injuries, a gradual reduction in disabling work injury frequency and, exclusive of the overwhelming influence of a catastrophe, a reduction in the silent cost per employee. The Federal Government, the employee, and the employee's family benefit from the Service's safety program. In the field of information-education, efforts to extend public understanding of the work of the Fish and Wildlife Service and to increase the effectiveness of bureau programs have been accelerated.

A broad survey to determine "the direction the informational efforts should take" was conducted. A comprehensive questionnaire developed and distributed to more than 500 staff members in the field to permit them to evaluate the need of the Service informational program in their localities.

Because information-education is a program responsibility which can be implemented at the field level, the new approach emphasizes the importance of coordinated efforts by staff personnel in the field as part of their official duties. In the northeastern section of the country where the Service's Office of Information is providing field coordination for personnel of the two bureaus in information-education work, significant progress toward better public understanding of the programs is beginning to appear.

In the central office where information, education and extension efforts are largely in a staff advisory role for the Service's two bureaus, the functions have been realigned into three major units: editorial services, audiovisual services and special program services.

A special interest is the increasing emphasis being placed on a public education campaign with respect to the objectives of Federal waterfowl regulations and changes in them which are necessary to protect species in serious short supply. Attention also is being called to the importance of halting wasteful hunting practices. The campaign employs TV shorts, posters, charts and special releases.

In conservation education and extension, publication of educational materials for student use received attention, and significant

with Boy Scout and other youth organizations continued. Assistance was also provided to the U.S. Junior Chamber of Commerce and the Standard Oil Company of California in their development of individual wide-scale privately-sponsored wildlife education programs.

The several international fishery commissions continued their activities in investigation and regulation. Satisfactory progress has been made in the solution of some difficult problems, but new problems emerge to test the best efforts in international cooperation. It is gratifying to note that many nations are now alert to the need for concerted action in the conservation of resources of common concern.

The Fish and Wildlife Service continued to aid the International Cooperation Administration in a program of technical assistance to friendly foreign nations. During the past year, fishery technicians were on assignment to the following countries: Bolivia, Surinam, British Guiana, Tunisia, Somalia, Pakistan, India, Indonesia, Vietnam, Cambodia and Korea. A total of 30 foreign students and observers arrived in the United States for technical training, and 10 of these were here at the end of the year. The training is designed to increase the knowledge and skills of the visitors so they can assume enlarged responsibilities in their home countries.

Bureau of Sport Fisheries and Wildlife

Daniel H. Janzen, *Director*



FOR THE BUREAU OF SPORT FISHERIES AND WILDLIFE, a component bureau of the Department of the Interior's Fish and Wildlife Service, fiscal year 1959 was highlighted by unusually satisfying achievements, as well as new problems in the preservation, restoration, and management of the sport fish and wildlife resources.

Progress in the legislative field was signalized by the enactment of major amendments to two key laws. The Fish and Wildlife Coordination Act was revised and expanded, and now provides that fish and wildlife conservation shall receive equal consideration and be coordinated with other features of water resource development programs.

This makes it possible for Federal construction agencies to incorporate enhancement measures in the form of land acquisitions and developments to benefit fish and wildlife as part of the work performed on water development projects. This new operational attitude is in sharp contrast to the previous authority which emphasized measures to mitigate losses. As time goes on, the benefits flowing from the Fish and Wildlife Coordination Act will be reflected in greatly increased recreational opportunities for the Nation's growing population.

Amendments to the Migratory Bird Hunting Stamp Act—strongly supported by sportsmen—accomplished several major changes. The price of the stamps that waterfowl hunters must purchase was raised from \$2 to \$3, and commencing with fiscal year 1961 all of the receipts from the sale of stamps, less the costs of printing and distribution, will be spent to acquire lands for waterfowl. The

marking of the income from the higher priced duck stamps will assure the financing needed to proceed with an accelerated acquisition program. Such action is in keeping with the urgent need to purchase rapidly disappearing marsh and water areas so as to perpetuate the sport of wildfowling on a substantial scale.

Authorization was also granted to use duck stamp funds for the acquisition of small wetlands and pothole areas for waterfowl production without the requirement that they be made inviolate sanctuaries. Waiving the sanctuary requirement will reduce the costs of managing a pattern of small production units spread over western Minnesota and the Dakotas. It will not increase the harvest materially because the production areas, due to their small size and the early departure of birds from them, do not offer high quality hunting opportunities.

Two significant amendments to the Watershed Protection and Flood Prevention Act, which is administered by the Department of Agriculture, were also enacted. Federal cost-sharing of fish and wildlife developments on small watershed projects is permitted, and the Secretary of the Interior is authorized to assist in planning fish and wildlife enhancement features, as well as damage prevention measures, for such projects. These amendments have opened up new fields for fish and wildlife betterment across the country.

Because of subnormal precipitation in the Prairie States over a 2-year period, nearly 50 percent of the productive water areas in Minnesota and the Dakotas have dried up. The same general condition prevails on the southern portion of the Canadian Prairie Provinces. Unfortunately, the birds pushed on by the drought encountered a late spring in the second choice reproduction areas further north in Canada. Cold rains and snows swept across the lands in May and the ice was slow in thawing. Thus, the birds were squeezed by an unusually late spring in the North and drought in the South. The outcome in reproduction was unknown at the year's end, but during previous droughts on the prairies, prairie nesting waterfowl declined drastically in numbers.

Alaska becoming a State is having its impact upon the operation of the Bureau. When Alaska was a Territory, the Bureau was responsible for the management of sport fish and wildlife there. The provision of the Statehood Act required effective protective machinery be established by the Alaska Legislature, followed by certification by the Secretary of the Interior, so that the wildlife resources will be protected in the National interest. These actions have been accomplished, and on January 1, 1960, Alaska will manage its fish and wildlife like any other State.

While the responsibilities of the Bureau of Sport Fisheries and Wildlife in Alaska have diminished, they will still be substantial.

the nearly 8 million acres contained in established National wildlife refuges will require the usual management attention. Also, cooperation will be rendered the State on controlling predators harmful to restock and wildlife, and in the enforcement of Federal fish and wildlife laws, including the protection of migratory birds, of which waterfowl receive the major attention.

Responsibility for the designing of projects and the performance of work on the highly important Federal aid in fish and wildlife restoration programs heretofore assumed by the Bureau are also being taken over by Alaska. As is the case elsewhere, the Bureau's role will be confined to passing upon the approvability of projects proposed by the State, and whether work on approved projects has been satisfactorily accomplished before State reimbursement claims are endorsed for payment.

Management of Fish and Wildlife

The Flyway Councils, composed of officials of the State game departments, have recognized in the management plans adopted by them the need for waterfowl surveys and banding. A number of States supplied personnel to assist the Bureau with these activities in Canada during the year. Flyway management plans call for a broader participation in the future by the States in the conduct of these activities. Flyway Councils have also shown keen interest in the depredations control projects, and have offered assistance in the way of manpower to carry out the depredations demonstration program in Canada.

The four Flyway Councils—Atlantic, Mississippi, Central, and Pacific—are preparing flyway plans dealing with the acquisition of lands for waterfowl and for the management of these birds. Dealing upon the peculiarities of the individual flyways, Council recommendations have stressed acquisitions in either the breeding or wintering ranges or in both of them.

Damage of Wetlands

Loss of Waterfowl habitat due to drainage continues to be one of the major problems confronting the Bureau. Farm drainage in Minnesota and the Dakotas increased sharply in 1958 over the average of the three preceding years. In the 91 counties containing the best remaining habitat, an estimated 10,000 potholes were drained in 1958.

In the Middle Atlantic States, cooperative planning

coastal wetlands is making progress, as evidenced by passage of the Long Island Wetlands Act under which the State of New York can assist the town boards on Long Island in developing marsh areas for fish and wildlife conservation and general recreation purposes.

Endangered Species

In its role as protector of endangered species, the Bureau has intensified research on whooping cranes and nene geese. A protective project also was initiated on the Laysan teal. Although the bald eagle is not in the category of an endangered species, a recent decline in Atlantic populations of this important bird has focused attention of Bureau research men on its breeding success. Research also has been intensified on the diving ducks, among which the redheads and canvasbacks hold high rank. These birds still are sufficiently abundant to provide hunting, but recent population

Census of Wintering Waterfowl on Federal Aid in Wildlife Restoration Project.



clines make it essential that they receive special attention to prevent over-harvesting.

The whooping crane fared better than in any of the past 20 years. The young of the year, the largest number of young recorded during 10 decades, were included among the 32 wild birds successfully entering at the Aransas Refuge in Texas.

The nene goose of Hawaii is being studied under contract with the Board of Commissioners of Agriculture and Forestry of Hawaii. Field studies revealed that the wild nenes had a reasonably successful nesting season last year.

In order to preserve breeding stock to insure against depletion of their native habitat, a number of Laysan teal, a highly vulnerable bird of the Island of Laysan in the Hawaiian Islands, is being distributed to a selected list of zoological parks for propagation. This work is being done in cooperation with the Hawaiian game personnel who captured the birds and sent them to the aviaries.

Island Game Birds

Field studies disclosed that, with the exception of white-winged doves, the population status of migratory game birds other than waterfowl remained at the same general level as in 1957. The white-winged dove breeding population decreased approximately 2 percent over that of the previous year. A proportional decrease in the 1958 fall flight of these birds was noted during migration. However, favorable nesting conditions this spring have resulted in a high degree of production which more than compensated for the decrease noted the previous fall.

Acquisition of Lands

The National Wildlife Refuge System was enlarged by the purchase of 28,361 acres of land in 112 separate ownerships, and the reservation of 46,713 acres of land by Executive and public land orders. Additions to the migratory waterfowl refuge system featured the 4,400-acre Pixley Refuge in Tulare County, Calif., and the 7,700-acre Buffalo Lakes Refuge in Randall County, Tex. These two refuges were the result of land transfers from the Department of Agriculture. In Alaska, the Simeonof National Wildlife Refuge containing 10,442 acres of land and water was established by the withdrawal of public land for the preservation and propagation of sea otter and other wildlife.

Migratory Bird Conservation Commission Action

The Migratory Bird Conservation Commission held one meeting during the year, and approved the purchase of two new refuges: the Mackay Island National Wildlife Refuge of 7,856 acres of land in North Carolina and Virginia, and the Modoc National Wildlife Refuge of 6,049 acres in northeastern California. The Commission also approved the acquisition of 11,300 additional acres for eight existing National Wildlife Refuges.

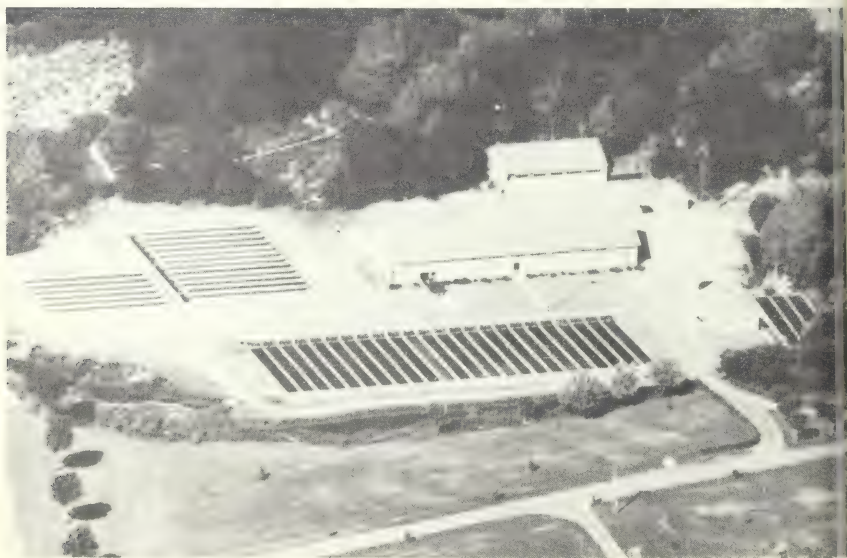
Land Acquired for Fish Research Facility

The Fish Research and Rice Area Act of March 15, 1958, authorized the acquisition of land and the construction of facilities necessary for research in the production of fish on rice-producing areas during the time the land is not in rice production. The Bureau acquired 86 acres in Arkansas for this purpose, and the remaining 211 acres needed are being purchased there.

Developments

Congress provided funds to continue the construction of new hatcheries at Garrison Dam, N. Dak.; Gavins Point Dam, S. Dak.; and Pisgah National Forest, N.C. Funds were provided to begin

Hagerman, Idaho, Fish-Cultural Station.



construction of a new trout hatchery at Willow Beach, Ariz. Funds are also provided to continue the improvement and expansion of facilities at seven existing hatcheries.

Expanding Hatchery Production

Agencies responsible for the maintenance of sport fish populations in the States are showing great interest and activity in the improvement and reestablishment of desirable fish populations. This includes the establishment of trout populations in reclaimed waters, below high dams, and the reestablishment of desirable warm-water species in waters inhabited by nongame fish. Combined with normal requirements, these activities have greatly increased the yield for fish from State and Federal hatcheries.

Improving Hatchery Operations

A determined, planned effort is being made to explore the groundwater potential at fish-cultural stations to supplement diminishing surface water supplies. As a result, additional water of good quality and temperature has been provided at a number of stations, and this work is continuing. The feeding of pelleted fish food was increased with promising results at many hatcheries. A program to make each region self-sufficient in fish egg production was initiated during the year with particular attention being given to desirable strains and species.

Federal Aid in Fish Restoration

This program, financed by the Federal excise tax on sport fishing tackle, provided \$4,705,000 available for the States and Territories in 1959.

During the year, 164 investigative studies which obligated \$380,000, stressed the development of new or improved fish management techniques through evaluation of artificial reefs in coastal waters, selective poison baits for control of undesirable fish, game animal forage fish stocking, the relation of sport and commercial fishery harvests, and electrical devices. Life history data collection was emphasized due to its basic importance to management. Findings of completed studies were made available in 19 bulletins and articles.

Habitat development work performed in 36 States, Alaska, and Hawaii, obligated \$2,054,000. Construction was initiated or completed on 33 public fishing impoundments, one-third of which

100 surface-acres. Such waters receive heavy public use as illustrated by the 4,800 anglers counted on one new lake during the first 4 days of fishing. Development of 99 fishing access sites opened additional waters to fishermen. Major improvements at these sites were access roads, parking lots, and boat launch ramps. Control or eradication of undesirable fish, control of noxious vegetation, installation of stream improvement devices, and construction of rough-fish barriers and fishways were undertaken to improve existing fishing conditions.

Land acquisition in 13 States obligated \$505,000. The 103 projects undertaken included 33 sites for stream and lake access, and dam sites and storage basins for future impoundments. Both State and wildlife restoration funds were used to purchase 16 other department purpose areas. More than 5,200 acres were added to existing State owned management areas.

Federal Aid in Wildlife Restoration

Apportionments to the States and Territories for the year totaled \$16,526,000. The 221 investigational projects on which work was performed obligated \$4,590,000. Earlier research disclosed basic habitat requirements and management needs. However, administrators still need up-to-date estimates of game numbers, production, and harvest. Most States participated in such resource inventories. Pooling of talent and funds to attack regional problems gained wider acceptance. Findings were made available through publication of 381 articles, bulletins, and books.

Land management to accommodate more hunters and increase game harvests continued through work on 342 habitat improvement projects which obligated \$10,780,000. Decrease in food and cover plantings on private farm lands was offset by beneficial soil conservation measures. In contrast, greater expenditures were directed toward intensive development of publicly owned or managed lands. Game production responded favorably to selective cuttings, creation of forest clearings later planted to food crops, and development of dependable water supplies to effect better game distribution. Building of hunter access roads, parking lots, and supervision of managed hunts resulted in the harvest of surplus game in many heretofore inaccessible areas.

Future hunting for the average sportsman will depend largely upon expansion of opportunity on public lands. A total of 5 land acquisition projects obligated \$4,544,000 for the purchase of new waterfowl areas, wetland potholes scheduled for destruction,



Horn Sheep—lambs, rams and ewes—trapped for transplanting to
rangeland on a Federal Aid in Wildlife Restoration project.

ough drainage, as well as upland game hunting areas, white-
dove nesting habitat, and band-tailed pigeon concentration
areas.

Fishery Management Activities

Providing technical assistance in the management of the many
sport fishing waters under Federal ownership or control, either
separately or in cooperation with the States, is an important Bureau
activity. The 225 Federal areas providing management services
during the past year have a combined area equal to that of Florida
and Michigan. At least 1 million man-days of fishing can be credited
to assistance rendered thereon.

Marked growth of interest in recreational fishing has been shown
at the military installations. Moreover, public fishing programs
are being inaugurated at some of them. Also, greatly increased
interest has been demonstrated on the Indian reservations of the
West. Fishing not only provides a recreational outlet for the
Indians, but at some reservations the sale of permits and other
services results in a sizeable income. At Fort Apache, Ariz., for
example, over 100,000 daily fishing permits were sold to nonresidents
of the Reservation in 1958.

Stream and pond surveys, fish population studies, and stock
recommendations were carried out on 12 National Forests in
cooperation with the States. Other cooperative work includes

The gathering of data and management measures applied to sport fishery resources of interstate waters, particularly on the Upper Mississippi River, the Lower Colorado, and the Roanoke River. Where coordination of interests and consolidation of manpower and equipment are advantageous to getting the job done, the Bureau endeavors to supply the necessary leadership. Cooperative agreements on fish stocking and other management activities were entered into with several States. These agreements insure the more effective use of hatchery fish, and prevent duplication of effort between the agencies.

Fish Distribution

Production and distribution of trout and salmon from Federal hatcheries increased 13 percent, by weight, above any previous year. The production of warm-water species was slightly below the high level of the year previous as a result of increased attention being given to the production of predator fish needed in the management of warm water fish populations. During the 12-month period covered by this report, over 2 million pounds of fish in the following numbers were distributed: trout, 24 million; salmon, 100 million; and warm water species, 83 million.

Exotic Bird Introduction

Important progress is being made in the cooperative foreign game bird introduction program. The States are making ecological surveys of game-depleted areas, and the Bureau specialists conduct research on potential foreign game birds, arranging for the acquisition and shipment of birds whose living requirements are found to compare favorably with our vacant or under-populated habitats. Studies were made in western Europe, Japan, India and Afghanistan. Introductions included Reeves pheasants, Japanese green pheasants, red-legged partridges, bamboo partridges, gray francolins, and blue francolins. Distribution is made on the basis of recommendation by the Exotic Game Committee of the International Association of Game, Fish, and Conservation Commissioners and the Bureau. This program is an excellent example of State and Federal cooperation toward increasing the Nation's wildlife resources.

Predator and Rodent Control

Agriculture is in the midst of a change comparable to the industrial revolution of 75 years ago. Mechanized specialization

on large acreages, requires an efficiency and specificity of animal damage control undreamed of a few years ago.

Forestry demands effective ways of controlling rodents which would otherwise delay reforestation from 1 to 10 or more years. In the Pacific Northwest, a year's delay results in a growth loss estimated at \$15 to \$18 per acre.

Other control problems, readily solved in sparsely settled areas where highly toxic control methods can be safely used, are vastly complicated by increasing human population and the resulting competition for land use. This greater intensity of land use calls for strenuous efforts by the Bureau to keep abreast of multiple demands for animal control in an increasingly complex world.



Animal control in and near grain elevators is an important part of Bureau cooperation with industry in the Clean Grain Program.

Success of the adjustment is attested by reports from benefited industries. Among livestock raisers of the Western States, losses from predators remain below 1 percent per year as compared to 10 or more percent before recent development of modern methods. Trappers throughout the Pacific Northwest are saving up to \$15 per acre in reforestation costs by using direct seeding which has been made possible by Bureau-developed control of rodent pests.

Rabies outbreaks in several places, including Arizona, California, the Dakotas, and Virginia, have been contained by joint efforts of public health agencies and the Bureau, which controlled wild animal carriers of the disease. Southern growers of truck crops, especially watermelon growers, have saved money and crops by using the Bureau's new methods for repelling rodents from newly planted seed.

The Bureau, in cooperation with State and other agencies, treated 4,960,000 acres to control rodent depredations throughout the country. Outbreaks of phenomenal numbers of cotton rats in Texas, and meadow mice in Oregon, California, Nevada, and nearby States were promptly attacked by emergency assignment of teams of Bureau specialists who worked with local officials in developing and using control methods to mitigate the rodent destruction. Methods for controlling depredations by nuisance animals and birds were demonstrated to groups of fruit growers and farmers during the year, and were the topic of many radio and television broadcasts in cooperation with the Extension Service. A rat control film was produced in conjunction with Purdue University, and 267 sets of color slides were prepared and distributed.

Cooperative Wildlife Research Units

The 16 Units are administered cooperatively by the Bureau, State fish and game departments, the Wildlife Management Institute, and the land grant colleges and universities at which they are located. These Units conducted research on 290 projects and 50 projects during calendar year 1958. Studies included some 55 species of birds and mammals, and covered a wide range of topics of interest to State and Federal wildlife managers. A total of 207 degrees were granted last year to wildlife students in Unit Schools, including 137 Bachelors', 57 Masters', and 13 Doctors'. This brings the number of degrees in the 23 years of Unit operation to more than 2,000.

Coordination Area Transfers to States

The State of Nebraska was granted the use for wildlife purposes of 2,550 acres of land, and the State of South Dakota 4,430 acres at the U.S. Army Corps of Engineers Lewis and Clark Reservation at Gavins Point on the Missouri River. These lands were made available to the Bureau under a General Plan and cooperative agreement, and were subsequently made available to the States by cooperative agreements between the Bureau and the two States.

lition, two parcels of former Indian school lands, containing 693 acres no longer needed for that purpose, were reassigned to the Bureau and made available to Kansas and Minnesota under cooperative agreements.

Federal-State Law Enforcement Programs

The high degree of cooperation that has been reached between this Bureau and the State conservation departments has aided immeasurably in a better understanding of management problems and in the development of methods by which to solve such problems. Enforcement personnel of the Bureau commissioned as State deputy wardens made numerous arrests for violation of State game laws, thereby reciprocating for the assistance received by them from State wardens enforcing regulations established to afford protection to migratory birds.

Enforcement

At 6 a.m., on September 5, 1958, 41 Bureau Game Management Agents, from 11 States, together with game wardens from the 3 States involved, served warrants on 95 individuals in the States of Wisconsin, Michigan, and Illinois. This was the largest operation of its kind in the history of game law enforcement. The individuals named on the warrants were charged with killing and selling waterfowl contrary to Federal regulations. Evidence gathered over a period of 2 years by a Federal investigator revealed that the persons charged were actively engaged in trafficking in waterfowl.

Market hunting, illegal since 1918, has nevertheless continued to flourish in many areas of the United States by means of an almost fantastic network of carefully concealed operations. The undercover operations conducted by the Bureau, resulting in the mass arrests, were undertaken because of numerous complaints reaching the Bureau from sportsmen and others that market hunting had reached serious proportions in the areas involved.

Of the 103 individuals charged, 92 were convicted, one found not guilty, and the charges against six were dismissed. Three defendants died before being brought to trial, and one is a fugitive from justice. Fines and court costs assessed amounted to \$36,631.

During the period 1952 to 1958, undercover operations conducted by the Bureau have resulted in the arrest of 229 individuals found to be engaged in the killing and marketing of migratory waterfowl.



U.S. Game Management Agents examine waterfowl taken by five hunters in excess of legal limit; deer taken during closed season.

Recreational Use

There were over 9 million visitor-days of public use on the National Wildlife Refuges in 1958. Wildlife observations, picnicking, swimming, and photography were the most popular with nearly 5½ million, or about 60 percent taking advantage of the opportunities. Fishing by 3⅓ million accounted for about 36 percent of the total. This sport showed nearly a 15 percent increase over the previous year. Hunting was enjoyed by 352,000 persons on 69 of the refuges. This included big-game hunting, primarily for deer where surpluses of these animals were available for harvesting.

The recreational use of National Wildlife Refuges increased nearly 90 percent between 1951 and 1958. Visitor use rose from 3.4 million to 9.1 million during this 8-year period. The annual increase in public use has shown some variation based primarily upon water conditions that affected fishing. On the basis of an average increased annual use of 23.6 percent in the past 8 years, it is reasonable to predict that there will be more than 17 million visitors on the refuges by 1968.

The extremely limited recreation facilities, many of which were constructed in the 1930's, have imposed unusual problems on refuge personnel. On many areas, expanded use will not be possible without provisions for further development and maintenance.

Upper Basin Activities

A structure to divert water from the Colorado River into the upper section of the Havasu Lake National Wildlife Refuge was completed by the Department's Bureau of Reclamation during this year. This diversion of water into the Topock Marsh east of Needles, Calif., was needed because the channelization of the river had greatly reduced fish and wildlife values. The diversion of water to this area permits the circulation of water through the marsh planned by this Bureau, and thereby restores its former attractiveness to migratory waterfowl.

An accelerated program for the development of power sites in the Columbia River Basin could jeopardize the famous salmon and steelhead runs of the Columbia River and its tributaries. Concern about the effects of high dams proposed for that part of the Basin caused the Department of the Interior to urge the Department of the Army to defer planning and recommendations for the construction of any more dams in the Middle Snake River below the mouth and including the Imnaha River until there is conclusive evidence that the extremely valuable migratory fish can be safely passed over the dams.

One of the most difficult fishery problems at high dams is that of safely passing downstream migrants. During the past year, skimmer devices were installed at the Pelton Dam on the Deschutes River and at the North Fork Dam on the Clackamas River, both in Oregon, and at the Brownlee Dam on the Snake River, Idaho and Oregon. Special studies were initiated at the Pelton Dam to determine the efficacy of these facilities for downstream migrants.

Sport and commercial fisheries of the Potomac River will be helped by the fishway now being constructed by the Corps of Engineers at Little Falls Dam, a short distance upstream from Washington, D.C.

ington, D.C. The fishway, which was recommended by the Bureau and Maryland and Virginia fishery agencies, will open up about 10 additional miles of stream to anadromous fish and provide badly needed spawning and nursery area.

Water Rights

Management of 500,000 surface acres of impoundments on National waterfowl refuges using an estimated 1,500,000 acre-feet of water per year, and on 91 fish-cultural stations using nearly 300,000 acre-feet of water per year, makes this Bureau a major holder of water rights. To conserve and protect these rights, a water inventory program to assemble full and detailed information on the use of water for which rights have been acquired was initiated during the year. Geologic source of water, quality, quantity, kind, and period of use are recorded. The availability of these data will provide accurate information for use as needed in the continued operation of the fish and wildlife installations. The need for these facts and data is highlighted by the trends in the enactment of water laws in the States under which water users are required to file technical information on the amounts and source of water in order to record vested rights to the use of specific quantities of water.

Fish and Wildlife Research

More food and greater opportunity for individual participation in wholesome recreation are important needs of a growing American population. The Bureau's fishery research is aimed at these long term and continuing National needs by looking for ways to produce more and better fish in hatcheries and by devising methods for getting greater sustained yield of desirable kinds of fish from our natural and impounded waters.

Fisheries

Sport fishery research was carried on at 15 laboratories and field stations:

| <i>Laboratory or station</i> | <i>Area of research</i> |
|---|--|
| Boothbay Harbor, Maine ----- | Atlantic salmon restoration. |
| Cortland, N. Y. ----- | Hatchery fish nutrition. |
| Leetown, (P.O. Kearneysville) W. Va. ---- | Diseases and parasites of hatchery fish. |
| Gatlinburg, Tenn. field station ----- | Appalachian sport fish management. |

*Laboratory or station—Continued**Area of research—Continued*

| | |
|--|---|
| Crosse, Wis. ----- | Fish population control. |
| Denver, Colo., Gulf Breeze, Florida field station ----- | Effects of pesticides on fish. |
| Idaho, Utah, Yellowstone Lake field station ----- | Rocky Mountains sport fish management. |
| Las Vegas, Nev., Convict Creek, Calif. field station ----- | Productivity of alpine lakes; variations in trout survival. |
| Libby, Mont., Wash. ----- | Fish cultural methods. |
| Marion, O., (P.O. Cook) Wash., Hagerman, Idaho field station ----- | Hatchery fish nutrition; histopathology of salmon. |
| Seattle, Wash. ----- | Diseases and parasites of hatchery fish. |
| New, established after mid-year. | |

Highlights of Research Accomplishments

Stream studies are contributing a better understanding of the importance of hatchery diets to the subsequent survival of stream-reared catchable-size trout, and to the nature and extent of conversion to natural feedings of such trout when placed in mountain streams.

Post-experiment surveys demonstrated that the earlier "reclamation" of two streams in the Department's Great Smoky Mountains National Park was successful. This involved experimental chemical treatment of the streams to remove unwanted species and restocking with Appalachian-strain brook trout. Abundant spawning and good survival augur well for sustained good fishing.

Experimental trout fishing regulations on four streams in the Great Smoky Mountains National Park have been evaluated; they have been well accepted, and have provided superb angling. They involve year-round fishing for fun only (all but trophy-size fish are returned to the water). This radical departure from tradition should, on the basis of experience to date, give increased angling opportunities to park visitors.

Raising young Atlantic salmon in screened live cars in salt water showed promise that methods for rearing the fish to a larger size before release can be developed for better survival and return.

A 5-year study of the fish populations in the Madison River system of the Department's Yellowstone National Park was completed this year, and points the way to substantial changes in management and regulations to improve fishing.

Followup to determine the effects of aerial spraying of hemlock for spruce budworm control in the Yellowstone National Park.

In 1957 showed that although the spray caused immediate severe reductions in fish food organisms, full recovery occurred in some of the streams in 1958. Chemical analysis of water, vegetation, and fish collected 2 months after the spraying, revealed that the insecticide had been carried as far as 55 miles downstream from the sprayed area.

Public Law 85-582, which directed the Secretary of the Interior to undertake a comprehensive study of the effects of pesticides on fish and wildlife, led to the development of new and joint laboratory facilities at the Denver Federal Center with the wildlife research staff. Program planning and staff recruiting were in progress at the end of the year.

In the field of trout disease research, fish tissue culture techniques were advanced; a promising drug was found for the control of kidney disease; and a rapid, reliable method was developed for detecting anemia. Through chemical analyses of trout blood, a start was made on the establishment of a diagnostic table for trout pathology. There are strong indications of relationships between blood component ratios and certain trout diseases.

Experimental evidence suggested that inclusion of certain raw foods in the diet of salmon in hatcheries is the principal mode of transmission of a chronic, infectious, debilitating disease. Changes in food preparation or feeding practices are indicated. Fish nutrition researchers established certain vitamin requirements for lake trout and Atlantic salmon. Both of these species are of particular interest in restoration programs through stocking of hatchery fish.

Nutrition experiments showed that by regulating calorie and protein intake, it is possible to reduce the protein in trout diets without disturbing growth and conversion rates. This opens possibilities for reducing costs in hatchery feeding. In salmon nutrition research, a direct dependence of the protein intake on water temperature was established; specific amino acid requirements for chinook salmon were determined; an improved vitamin test device was developed to furnish adequate protein intake to the fish in different water temperatures; and techniques for rapid amino acid assay of diet and tissue components were adapted for practical use.

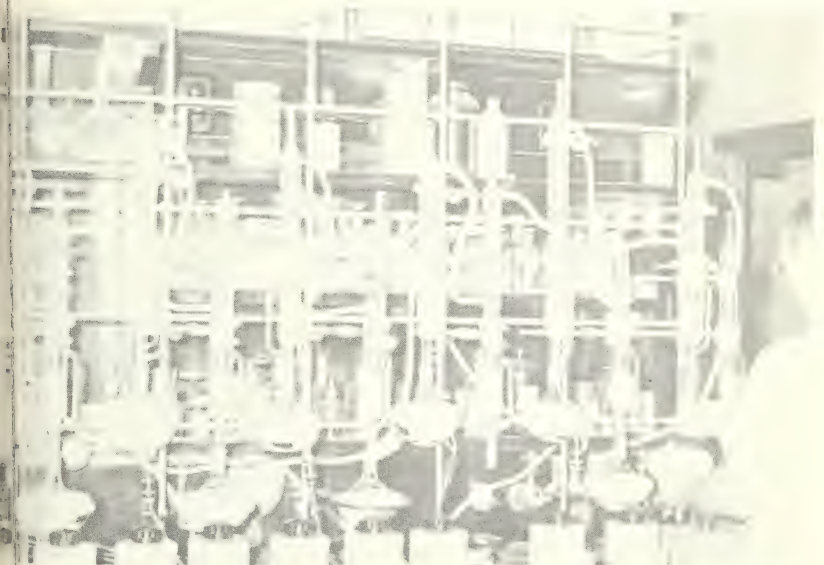
Experiments with controlled light demonstrated that maturation of salmon can be accelerated to reduce holding time and mortality and thus increase the egg take. With this finding, hormone injection experiments were discontinued.

Wildlife

As directed by the Congress in Public Law 85-582, the Bureau intensified its research on wildlife-pesticide relationships. Laboratory

by tests were continued on physiological effects of minute dosages of many insecticides, and field studies were carried on to determine the effects of control programs on the fire ant in the South, the Dutch elm disease in the North, and on grasshoppers in the Western States.

Bureau field studies disclosed heavy wildlife losses from the fire ant control program. Quail, rabbits, and ground-feeding song birds suffered severe losses and almost all species were affected. Robins are most vulnerable in Dutch elm disease control. Earthworms concentrate the toxicant in their tissues, and birds with a high earthworm diet are in special danger. Fear also has been expressed for the woodcock, and studies have been initiated on this species.



Equipment used at the Patuxent Wildlife Research Refuge to determine whether birds and mammals found dead in areas treated with pesticides contain lethal quantities of toxicants.

Research has demonstrated that bird losses in Dutch elm disease control can be diminished by use of mist blowers which reduce "padding" under trees, by applying treatments before leaves appear in spring, and by using methoxychlor instead of DDT in control of the bark beetles which carry the disease. Modifications of techniques and rates of application of pesticides are being sought in cooperation with the Department of Agriculture in order to reduce mortality to wildlife resulting from the fire ant control program.

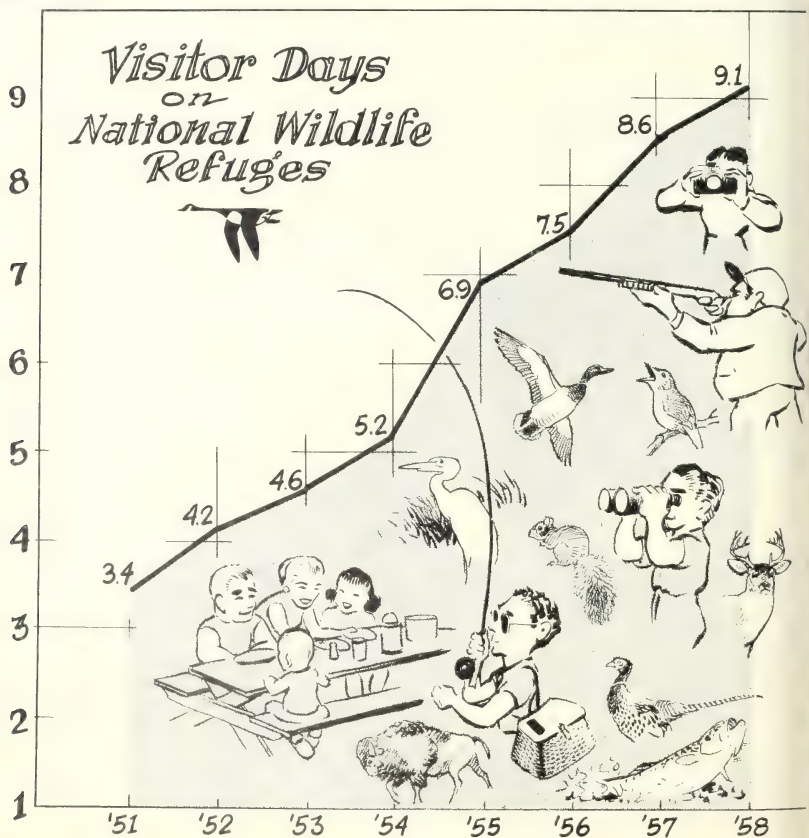
Forest-Wildlife Relationships

A biologist was assigned this year to cooperate with the U. S. Forest Service at Asheville, N.C., in research on forest wildlife production in relation to timber management. Problems under investigation include the effects of wildlife populations on forest reproduction, the effects of timber management upon wildlife, and the testing of specific management techniques for forest wildlife species. Similar problems are being studied in the Lake States of Colorado, Montana, Texas, and Utah. The effects of mice in preventing reseeding of forests is being studied in the Douglas fir region of western Oregon, and new techniques for protecting seeds and seedlings are being developed.

Management of Waterfowl Areas

Production of waterfowl foods and the management of Atlantic coastal wintering areas are being studied in a cooperative project.

millions



in Virginia and North Carolina in the Back Bay-Currituck Sound area. Encouraging progress has been made in analyzing factors responsible for food production and in developing techniques for improving these important waterfowl wintering areas.

Significant progress has been made in developing effective control measures for cattails, phragmites, and needlegrass, all of which are important pest species in many waterfowl wintering marshes. Promising leads have also been developed on the control of two other important weeds—alligator weed in the Southeast and water-chestnut in the Northeast. Pest plant control and improved water management techniques which have been developed in research in Atlantic coastal areas make it possible to convert many types of lands that have previously been considered worthless for waterfowl into highly valuable breeding and feeding grounds for ducks and geese.

Mourning Dove Studies

The Bureau has expanded its research on mourning doves in cooperation with State biologists throughout the dove hunting regions. The management of the dove is complicated because of wide variations in production and migratory movements in its continental habitat. Preliminary banding studies have demonstrated that three units—Eastern, Central, and Western—can be delineated for the purpose of applying more effective management measures to such populations. Each of these units appears to produce some 95 percent of the birds killed within its boundaries, and about 95 percent of each unit's harvestable production is killed either within the unit or outside the United States. If further research bears out these preliminary conclusions, the designation of the three units will do much to clarify and help solve the Nation's complex dove management problems.

Research on dove diseases has been concentrated on trichomoniasis as the principal disease. A superficially similar disease, "fowl pox," which might readily be confused with trichomoniasis, has been demonstrated in captive doves.

Publication of Research Findings

Results of research by staff members appeared in numerous publications during the year. Among these have been books on the Birds of Georgia, the Birds of Maryland, and the Bobcat in North America. Approximately 60 shorter articles were published in various scientific journals.

Bureau of Commercial Fisheries

Donald L. McKernan, *Director*



MAJOR ACTIVITIES of the Bureau of Commercial Fisheries, a component bureau of the Department of the Interior's Fish and Wildlife Service, are the research and services provided to help wisely and fully utilizing the Nation's fishery resources.

Industrial research ranges from explorations for new fishing grounds to technological work for determining better ways of utilizing the resources. In the field of industrial services, market news information is provided to industry, statistics are collected to show trends in production, studies are conducted on the economic problems of the fishing industry, and market development programs are provided to promote the wider use of fishery products.

Services in international trade and tariff problems have become another significant phase of the Bureau's activities. The Saltonstad-Kennedy Act has continued to provide funds to assist the domestic fisheries, with emphasis on research and marketing.

The Bureau's exploratory fishing vessels made important commercial discoveries during the year. Concentrations of bluefin tuna were discovered in January in the Gulf Stream area of the western North Atlantic by the vessel, *Delaware*. This discovery has added much to the limited previous knowledge of the seasonal distribution and commercial potential of bluefin in those waters. Large concentrations of shrimp were found to be available in Central Alaskan waters; the exploratory vessel, *John N. Cobb*, located commercial quantities of this resource in the lower Cook Inlet, the southeast side of Kenai Peninsula, and in the Kodiak Island areas.

Investigation of midwater and surface-schooling fish in the Gulf of Mexico by the *Oregon* indicated that at least six little or not utilized species are present in possible commercial quantities. Experiments with several types of gear are under way to determine the most practicable method of capturing these fish. The *Oregon* as

ducted explorations for shrimp on the high seas off the coast of northern South America. Principally because of these explorations, a fleet of U.S. shrimp trawlers moved to the area to fish on a full basis.

Successful development and testing was completed of air-bubble equipment designed to direct herring (Maine sardines)—from areas accessible to conventional gear—into inaccessible areas where they can be caught easily. Electrical fishing methods were also tested in conjunction with conventional gear used to catch the herring.

The Fisheries Loan Fund Program, which was authorized by Section 4 of the Fish and Wildlife Act of 1956, was continued during the year. Loans are made for financing and refinancing operations, maintenance, replacement, repair, and equipment of fishing gear on vessels, and for research into the basic problems of fisheries.

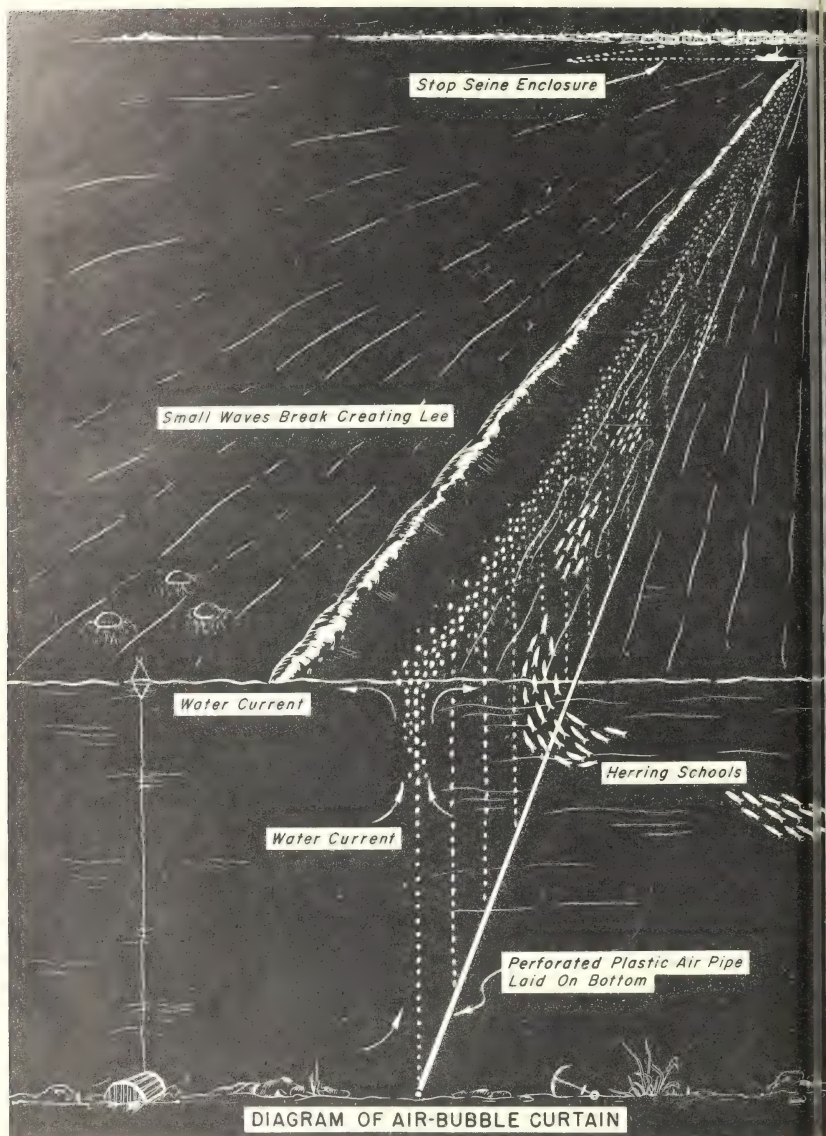
New applications for 140 loans under the Fund, totaling \$2,800,000, were received during the year. At the beginning of the fiscal year, the backlog of cases being processed or deferred at the request of the applicants was 63, and at the end of the year 23. Eighty-five applications were approved for \$1,900,000, and 80, totaling \$1,700,000, were declined or found to be ineligible. Fifteen applications were withdrawn before a final decision was reached. It has been estimated that the present annual catch of vessels receiving loans is about \$2,000,000 pounds, or 5 percent of the total U.S. catch.

The Bureau has also worked on programs to reduce accidents to fishermen at sea. A Port Safety Committee for fisheries in Portland, Maine, was formed through the efforts of the New England Fisheries Safety Program; the Committee is the first of its kind in the United States. Other New England ports will be assisted in organizing such committees.

The fishery-product inspection program of the Bureau is 1 year old; it furnishes continuous inspection services to 23 processing plants, and has certified approximately 75 million pounds of processed fishery products. Approximately 60 different products are inspected on the basis of approved product specifications.

Besides plant inspection, offices in four major cities furnish lot inspection services to State, Federal, institutional, and private purchasing agencies. To date, five voluntary U.S. standards for grades of fish have been promulgated and are in use; four additional standards are in the final stages of preparation.

Research in fish oils during 1958 has been diversified and exceptionally successful. It was found that fatty acids derived from fish oils have potential medicinal use since they markedly lower the high blood-serum cholesterol levels associated with the "artery" killer—atherosclerosis. Fish oils have also proven to be



The air-bubble curtain was developed by the Bureau of Commercial Fisheries to guide herring to areas where they might be captured by conventional gear.

in iron-ore concentration and in the dressing of hides into certain leathers. Other studies have developed very effective agents which have extended, by a factor of 15 times, the storage life of antioxidant-treated fish oils. Techniques have been perfected for detecting and identifying metallic impurities in fish oils.

Finally, a review has been published of the world's scientific literature on intermediary metabolism in fishes; this is the first work of its kind and may lead to a better knowledge of the mechanisms of oxidation of fish oils, a longstanding problem for fish processors. During the past year, conclusive scientific studies proved the value of adding fishmeal to commercial animal feeds. Broiler chicks fed fish meal and fish solubles showed a weight gain 16 percent greater than broilers fed a comparable all-vegetable protein diet. This increased growth is attributed to the completeness and digestibility of fish protein, as well as to the presence of vitamins and of as yet unknown growth factors.

The cost of fishing or the cost of production, as the term is generally used, has a specific significance in many segments of our fishing industry, and has been studied by Bureau economists for the benefit of our domestic fishermen. Tuna and groundfish producers, in particular, face intense competition from foreign producers who export their products to the United States.

The San Diego State College Foundation, under a research contract, is reporting on costs in the albacore industry in relation to areas fished, the types of vessels employed, and other factors of special significance in determining the competitive status of the industry. Another similar contract report is in preparation by Boston College on the New England groundfish industry. The University of Washington is analyzing the economic effects on the halibut industry of government-imposed controls on catch, as well as the industry's program of voluntary layover of vessels between fishing trips.

Studies were conducted on transportation problems in the industry, including a study of the importance of "exempt" trucks. Work continued on records of parity prices to show the relative economic prosperity or depression of various segments of the industry, on the long-term outlook for production and consumption of fishery products, and on the relation between capital and labor used in the fisheries. In the field of consumer research, a special study was undertaken to provide information to the industry on reaction or innovation in consumer buying habits for canned fishery products.

The Bureau's representatives inspected 14 fishery cooperatives to check compliance with the Fishery Cooperative Marketing Act of 1934, and to obtain statistical information on activities. Four new fishery cooperatives were organized during the fiscal year.

Members of the industry—fishermen, buyers, and distributors—were aided in determining the current market for fresh, frozen, and canned products by information published daily in the Market News Service's Fishery Products Reports. Marketing specialists located in Boston, New York City, Hampton (Va.), New Orleans, San Pedro

(Calif.), Seattle, and Chicago collected and distributed data on landings, receipts, stocks, imports and exports, market conditions and prices for all types of fishery products. Fifty port reports in the principal fishing and distributing centers of the Nation continued to collect data for daily reports: these reports show trends in marketing all over the world.

The monthly periodical, *Commercial Fisheries Review*, in its 25th year of service to the industry, presented special articles and news on progress in all phases of fishery research in the United States and abroad.

In line with its responsibility for promoting the use of domestically produced fishery products and in an effort to develop the fullest and wisest use of our fishery resources, the Bureau conducted an aggressive and effective market development and consumer education program. This nationwide program was designed to expand traditional markets and to create new market demand for U. S. fishery products.

To obtain special information on distribution and consumption patterns of various fishery products, the Bureau let a number of market research contracts to private research firms and Government agencies. This information should prove of value to industry and Government in the planning of marketing programs.

Consumer-education efforts were timed to coincide with periods of greatest promotional activity by industry. Recorded radio spot announcements and television drop cards and slides, dealing with the nutritional value of fishery products, were given wide distribution. Two million fish and shellfish recipe folders were distributed through retail food outlets, and educational material and tested recipes were made available to such mass feeding bodies as schools, other institutions, in-plant feeders, and restaurants.

The Bureau's home economists presented 193 fish cookery demonstrations, appeared on 66 television and radio food shows, and participated in 5 national food trade conventions.

Sixteen fishery educational films are in distribution through some 160 film libraries and Government distribution channels: to have an annual audience of well over a million persons, exclusive of television viewers. Two industry-financed motion pictures are now being made and agreements have been signed for the production of two others.

The use of "rough" fish for animal food—successfully developed during pilot research efforts in the Lake Erie area—is being expanded. New markets are being found in inland and coastal areas where rough-fish problems exist.

Detailed statistical surveys on employment in the fisheries, volu-

and value of the catch, and the production of manufactured fishery products for 1957 were completed for all sections of the United States. Similar surveys for 1958 were undertaken, and completed in some areas. The Bureau also published a detailed statistical review of the 1958 fisheries of the United States and Alaska. Data are assembled on the U.S. catch and its disposition for publication in the Food and Agriculture Organization's Yearbook of Fishery Statistics for 1958.



Specialists demonstrate fish cookery and publicize standards and inspection program on popular television cooking show.

Economic and biological data on landings of fish and shellfish in the North Atlantic, and of shrimp in the South Atlantic and Gulf of Mexico, were made available to research workers. An historical report was prepared on the United States tuna fishery. Detailed biological operating unit data were compiled for Atlantic and Gulf of Mexico purse-seining for menhaden and otter trawling for fish and shrimp. Monthly reports continued to be issued on the following subjects: landings of fish and shellfish in 14 coastal States and in 1958; landings and holdings of frozen fish; production of fish meal and

oil; foreign trade in fishery commodities, and quarterly production of fish sticks and portions. Monthly summaries—based on items which account for over 90 percent of the domestic production from the U.S. catch—were released.

Developments in the fisheries of other countries are continuing to have a profound effect on the U.S. fishing industry. These effects were closely followed during the year. Background papers and reports on trends and developments in the fisheries of overseas countries were prepared for the information of other Government agencies, the Congress, the trade, and the general public. In many cases, these reports were the result of direct requests to the Bureau for specialized information.

A series of reports on overseas fishery developments was started with accounts of two major developments in 1958—the expansion of the U.S.S.R. high-seas fisheries and the expansion of Japanese fisheries based in overseas areas.

A formal agreement to bolster and expand a foreign reporting program was signed by the Department of the Interior and the Department of State. The agreement spells out the responsibilities of each Department in the selection, assignment, and duties of attachés. Fishery attachés are now stationed in Mexico City and Tokyo. The objective of this program is to achieve worldwide coverage of foreign fishery developments of importance to the U.S. fishing industry.

The Bureau has expanded its studies on international trade and tariff problems as they affect the domestic fisheries. It has worked particularly towards the liberalization of import restrictions on U.S. fishery products. In the course of the year, restrictions were lifted by the United Kingdom on all kinds of canned fish from the dollar area. Bureau observers participated in meetings held by the Organization for European Economic Cooperation to examine the fishery policies of Western European countries with a view toward improving the production and marketing of fishery products. A report was published describing the relation of the newly established Common Market to the U.S. fishing industry; our present large exports of fish oils to Western Europe may be seriously affected by future Common Market tariff rates.

Biological Research

Biological research on the fisheries has developed rapidly in recent years, in America and throughout the world. It now involves many highly specialized areas of the life sciences and related regions.

Physical science. The following summary of recent biological research of the Bureau of Commercial Fisheries is presented below:

Shellfisheries

Commercial shellfish research seeks to control predators and diseases, provide a favorable fishery environment, and improve methods of shellfish culture so increased production will result.

The fungus disease *Dermocystidium* causes serious oyster mortality along the Atlantic coast from Virginia to Texas. To develop an oyster population which will resist it, fungus-resistant South Carolina oyster seed have been transplanted to Florida.

Some New England hard clams were found to grow four times as fast in Florida waters as in New England waters while others grow at least twice as quickly.

Tests at Boothbay Harbor, Maine, and Pensacola, Fla., show lime-treated bait will control green crabs which prey on hard clams. Clam survival was higher and green crab populations lower in the protected areas than in the unprotected ones.

Studies in Oyster River, Chatham, Mass., show oysters grown on rafts grow faster and are healthier than those grown on bottoms. Oysters suspended below a raft are expected to reach marketable size by the fall of 1959, when they will be two years old. If they had been bottom-grown instead of raft-grown, they would have required four or five years to reach that size. The mortality of raft-grown oysters was 17 percent in 1958 and over 90 percent in bottom-grown oysters.

Studies are being made to determine the amount of radioactivity which man may acquire from eating marine fish and shellfish. Strontium 90 does not concentrate in edible portions of seafoods since it is deposited in the shells. Cesium 137 accumulated slightly in edible portions and, thus, may be one of the more important fission-product contaminants of seafoods. Other fission products are taken from the water only to a limited extent and do not impart a high radioactivity to seafood organisms.

Fish and shellfish concentrate radioactive metal ions to high levels. Although present in marine waters in small amounts, these contaminants are passed through the food chains to seafoods. The intake and the accumulation of zinc 65 and cobalt 60 are being measured.

The heavy oyster setting in Long Island Sound in 1958 did not significantly increase the oyster resources because drills and other gear killed most of the young oysters soon after they had set.

Commercial oyster set may be obtained from artificial salt-water ponds. In an artificial pond on Long Island, successful sets of American oysters were obtained by releasing, ready-to-set larvae in the pond. Light sets of European oysters, *Ostrea edulis*, and Japanese clams, *Tapes semidecussata*, also were obtained in this pond.

Methods for controlling enemies and competitors of juvenile oysters and hard-shell clams grown under hatchery conditions at Milford, Conn., were developed. Certain vital dyes, a saturated solution and chemicals controlled and often eliminated fouling organisms, such as hydroids, tunicates, worms and mussels. Such drugs, antibiotics, fungicides and temperature manipulations protected young mollusks from diseases.

Studies at the Milford, Conn., Laboratory indicate that creating chemical barriers around shellfish beds to prevent enemies from entering them may be effective, especially against predacious gastropods, such as oyster drills, *Polinices*, *Busycon*, and others.

The Annapolis, Md., and Franklin City, Va., Laboratories developed a promising method of controlling the movement of oyster drills *Urosalpinx* and *Eupleura* which prey on oysters. This method consists of erecting around an oyster bed a low plastic screen fence with a strip of copper attached to it. Since drills will not cross this copper strip, they do not enter the oyster bed. In a field test of this method in 1958 on a half-acre plot, 75 percent of the oysters survived while nearly all oysters in a nearby unprotected area were lost.

Anadromous Fisheries

The populations of anadromous fishes can be made more productive than they are because they spend part of their lives in fresh water. Streams can be improved, pollution abated, better fishways built and adequate spawning escapements permitted. The Department's Fish and Wildlife Service, as research agency of the Atlantic States Marine Fisheries Commission, continued observations on the Hudson River and the Connecticut River shad populations. The Connecticut River population is approaching its 1941-46 level when the best recorded catches were made. This increased population abundance resulted from an increased number of shad which were allowed to escape the fishery and spawn. The fishway on the Connecticut River at the Hadley Falls Dam, Holyoke, Mass., passed a record number of shad during the 1959 shad run.

Research on managing the Atlantic coast shad resources centered on the St. Johns River, Fla., during the 1958-59 shad run. Through use of catch, effort and tagging data a method was devised



Plastic tag is inserted in the cheek of a 2-year-old Passamaquoddy shad.

determine the shad population in this river for each year in which data are obtained.

Dams and pollution in the Roanoke River, Albemarle Sound, and other areas, threaten sustained abundance of the striped bass population. To resolve these problems, a cooperative study for developing this river basin by scientific means began in 1955. Research on the population and spawning status of striped bass in Roanoke River in relation to industrial development and water released from power plants upon the spawning grounds has been completed.

In the spring of 1959 the Bureau, Maryland and Virginia conducted research on striped bass on Chesapeake Bay. They tagged 20 striped bass in the Potomac River as a part of the research designed to determine seasonal, annual and age-specific migrations, estimates of population size and mortality rates, size and age-class composition and homogeneity of races.

In California and the Pacific Northwest, research on behavior patterns and survival of fish under extremes of environment is designed to understand fluctuations in abundance of the commercial fish. Basic and developmental research is directed toward the passage of fishes at water-use projects.

Research for the International North Pacific Fisheries Commission, formed by Canada, the United States and Japan, has progressed steadily. Two chartered vessels completed 78 gillnet sets in the North Pacific and Bering Sea during the spring and the summer of 1958. The catch of 5,462 salmon included 1,190 reds, 3,877 chums, 194 pinks, 175 silvers and 26 kings. Compared with the catches in 1957, catches in 1958 reflect a marked decline in the abundance of pinks. Chums were in comparable numbers both years.

The widespread salmon sampling program throughout the North Pacific Ocean and adjoining seas and coastal areas featured increased sampling coverage off the Asian coastline. Red, chum and pink salmon samples collected by the United States, Canada and Japan for racial studies totaled 21,632 whole salmon and 2,811 salmon blood samples.

The second season of experimental work on guiding seaward migrant fingerling salmon with electricity at the Lake Tapps fish site is in progress. Results show at least 90 percent of the yearling and 2-year-old coho salmon moving through the area are diverted into bypass traps by the electrical barrier which is operating at an economic power consumption level. These findings also indicate the probability of future reductions in electrical and mechanical instrumentation and show that under certain circumstances electricity can be efficiently used to divert migrating fingerling salmon.

Comparisons of the performance of salmonoids in experimental "endless" fishways indicate that pool-type fishways having a slope steeper than the commonly accepted 1-on-16 may be feasible, provided proper hydraulic conditions are obtained in the steep slope. These experiments were conducted at the Bonneville Dam Fisheries-Engineering Laboratory on the Columbia River and utilized adult migrating salmon and steelhead trout which were passed through test fishways with slopes of 1-on-8 and 1-on-16.

Surveys of the Yakima River system indicated the chinook salmon escapement in 1958 was slightly less than half that in 1957. The downstream migrant trapping project at Prosser resulted in counts of 145,000 chinook and silver salmon from April 1 to June 1, 1958. Surveys above Rocky Reach Dam indicated fish passed Rocky Reach Dam through temporary fish passage facilities with noticeable deleterious effects.

In Alaska, efforts are being made to predict the number of adult salmon which will return from the Pacific Ocean to the streams to spawn. Pink salmon fry in Southeastern Alaska and in Prince William Sound were dyed with neutral red stain, released and trapped downstream. In the Bristol Bay area, the commercial catch was sampled for age composition, adult red salmon were

enumerated from towers and downstream migrating red salmon bolts enumerated with fyke nets.

Studies to determine the fresh-water survival of salmon to Alaska continued. At Little Port Walter a count was made of upstream migrating adult pink salmon and downstream migrating fry. Experiments with young pink salmon in the stream gravel were conducted to measure their survival rate. Research at Brooks Lake concerned the factors affecting the survival of red salmon in the lake.

Lake Fisheries

To save lake trout and other fish from the predatory sea lamprey and, therefore, restore the livelihood of many fishermen, research and control measures were continued against the lampreys. Success in developing and testing selective toxicants that destroy lamprey larvae without significantly harming fish and other aquatic organisms made possible full-scale chemical control operations in streams tributary to the south shore of Lake Superior throughout the year. By the end of the year the toxicant had been successfully applied to half of the United States tributaries that will require treatment. To achieve this, advance operation of electrical barriers that block spawning of lampreys was reduced on Lake Michigan. Barriers were still operated on Lake Superior to prevent lamprey reinfestation of treated tributaries and to provide a measure of results from chemical control. The lamprey research and control program is carried out under agreement with the Great Lakes Fishery Commission, established by treaty with Canada in 1956.

Counting tower used to count red salmon migration on Egegik River.



Marine Fisheries

Research on marine resources encompasses the waters of the Atlantic Ocean from the Grand Banks to Florida, the entire Gulf of Mexico and the western and central Pacific Ocean. These studies, aimed toward obtaining maximum continuing yields from the ocean fisheries, include not only investigations of the biology of the more important commercial species but also research on the oceanographic environment. Fluctuations in ocean currents, sea temperatures and fertility of the waters appear to account for major, and sometimes catastrophic, fluctuations in some sea fisheries.

Studies of sea surface temperatures, conducted at Stanford, Calif., for the period 1936 to 1958 show that water temperature along the West Coast and in the Gulf of Alaska increased by more than 2° F. and in some regions by as much as 8° F. between June 1936 and June 1957. This change was accompanied by a remarkable recovery of the California sardine during the fishing season of 1958 and a phenomenal increase in the sport fish catch of barracuda and yellowtail in 1957, with good catches much farther north than in many years. In the western and central Pacific, sea surface temperatures decreased a comparable amount.



Sea lampreys that have been killed by a selective toxicant: *above* before transformation has started; *below*, an individual that is just completing transformation to the parasitic stage.

Studies to determine the need for conserving the eastern Bering Sea king crab stock centered on growth, abundance, effects of fishing and relations of distribution and abundance to environmental conditions.

cons. Abundance estimates have been developed and tagged crabs released to provide information on mortalities.

New England groundfish investigations indicate that the international regulation 4½-inch mesh is effectively saving young haddock. The entrance of one or more large year classes of small cod on the fishing grounds, a size category absent in recent years, demonstrated that the 4½-inch mesh is also an effective saving-gear for this species. An estimated more than half million small cod, which would have been caught by the preregulation small mesh, escaped to be caught at a larger size.

The fate of cod eggs spawned off the mid-Atlantic coast is being investigated by drift bottles, dropped from United States Navy ships in February 1959. Recoveries of tagged yellowtail flounders indicate three New England stocks are to be considered in management recommendations. These taggings have also delineated seasonal movements and promise to provide estimates of fishing mortality. Studies to clarify the taxonomic relations of three recognized groups of North Atlantic redfish will materially assist in consideration of international management recommendations for this species. Research on the New England scallop fishery demonstrates that a substantial increase in scallop yield would have resulted if a 12-inch ring had been in use in scallop drags on Georges Bank in 1958. Adoption of a larger ring was considered by the International Commission for the Northwest Atlantic Fisheries in June 1959.

Menhaden investigations show that variations in year brood abundance account in part for fluctuations in the catch in different areas. Increased fishing effort, accompanied by a progressive decline of the older age groups and a greater dependency upon individual year broods during the past two seasons, suggests that the fishery along the entire Atlantic coast may be subject to further decline below the 1957 and 1958 season unless reinforced by a very abundant 1958 year brood.

Recaptures of stained shrimp released in Florida and Texas waters show Florida Bay and the waters of the Department's Everglades National Park are important nursery areas for young pink shrimp.

Pink shrimp from the Everglades National Park, recaptured 18 months later in the Tortugas pink shrimp fishery, had tripled their weight and traveled more than 100 miles. Those recaptured in Galveston Bay traveled up to 25 miles a week.

Studies of the Gulf industrial fishery utilizing species for pet food, fish meal and oil show the heaviest fishing occurs in Mississippi Sound and off the Mississippi River delta in waters less than 90 fathoms deep. A total of 104 species comprising 55 families occur

tribute to this fishery. Croakers, spots, white trout and porg account for about 75 percent of the catch. Several plants operate throughout the year.

Intensive hydrographic and plankton surveys in Tampa Bay and adjacent waters during the past year show that the fish-kill red tide organism, *Gymnodinium breve*, is more abundant in offshore waters than in estuarine areas during the winter. Laboratory studies of tolerance limits of the red tide organism indicate that salinity does not reach a sufficiently high concentration to limit its occurrence in the open waters off the Florida coast, but that low salinity may limit the organism's distribution in estuarine areas.

Tuna research in the western and central Pacific revealed that surface temperatures in some of the fishing areas were as much 8°-10° F. colder than those observed during the summers of 1955 and 1956. The productivity of these areas, as evidenced from standing crops of plankton and forage organisms, was considerably reduced from that observed during previous years. Experimental fishing did not produce the yields predicted from earlier surveys in 1955 and 1956. Studies in French Oceania waters show the number of sightings of skipjack and yellowfin reached a peak during January.

Seining fry from a brood tank at the Bureau of Commercial Fisheries tilapia rearing plant on the island of Maui. Fry-holding tanks may be seen along either side of the brood tank.



1 March. Skipjack larvae abounded in the Marquesas area during January to March.

To alleviate the natural bait shortage in Hawaiian waters, the Honolulu Laboratory successfully used *Tillapia* and the Marquesan sardine. The 150,000 Marquesan sardines which were introduced in waters near the island of Oahu between December 1955 and March 1959 are successfully reproducing.

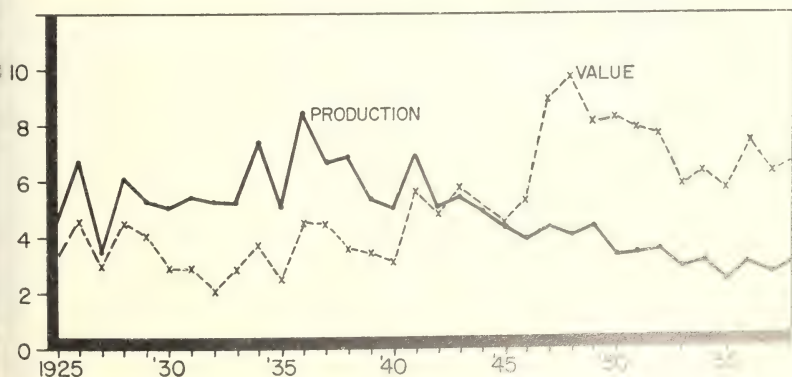
Two subgroups of herring in the Gulf of Maine have been demonstrated by the use of fairly new techniques: serology and parasitology. Tagging in the Passamaquoddy Bay area of over 100,000 herring show they move freely throughout the Bay area. Otolith (ear bone) studies indicate fall-spawned fish comprise the bulk of the landings.

Alaska Commercial Fisheries

In 1958, the commercial fisheries of Alaska, including the fur and byproducts industry of the Pribilof Islands, yielded products totaling 214,009,888 pounds having a wholesale value of \$83,148,351. Comparable production for 1957 was 200,359,388 pounds valued at \$472,050.

Alaska's pink salmon fisheries produced the best pack of this species since 1949, reflecting the results of a 4-year fishery rehabilitation program in the important pink salmon producing areas of the eastern Alaska and Prince William Sound. At the same time, the production of red salmon was the smallest on record as a result of a weak run in the major red salmon producing area of Bristol Bay. Salmon products of all species totaled 154,543,000 pounds,

Production and value of canned Alaska salmon, 1925-58.





Fish passage facilities on the east bank of the Deschutes river at Pelton dam include the upper portion of the 3-mile-long fish ladder and downstream migrant holding structure in foreground.

valued at \$71,847,000, as compared with 135,849,000 pounds valued at \$68,157,000 in 1957.

With regard to other species, there were declines in the production of herring, sablefish and clams as compared with 1957, while landings of halibut and shrimp increased. Sablefish production dropped from 3,548,000 pounds in 1957 to only 1,093,000 pounds in 1958, while increased landings of shrimp upped the production of this species from 700,000 pounds in 1957 to 1,266,000 pounds in 1958.

There were 20,614 persons engaged in the fisheries of Alaska in 1958, of which 12,136 were fishermen, 1,108 were transporters and 7,370 were shoresmen, employed in connection with 157 wholesale and manufacturing establishments. In 1957 comparable totals were 23,130 persons engaged in the fisheries, including 12,203 fishermen.

94 transporters and 9,633 shoresmen employed by 170 concerns, the 157 operating concerns in 1958, 48 were engaged in handling fish and frozen fish and shellfish, 47 in curing fish, 49 in canning fish and shellfish, and 7 in manufacturing byproducts.

Fishing gear used in the Alaska salmon industry in 1958 included 1 trap, 1,193 purse seines, 340 beach seines, 5,200 gill nets, 42,470 mon troll hooks, and 5 fish wheels.

In addition to 49 permanent personnel, the Bureau employed 200 seasonal streamguards in 1958 to supplement the enforcement personnel. A total of 6 seagoing vessels and a fleet of smaller boats was used in the administration of the fisheries. A fleet of aircraft including 6 twin-engine Grumman Goose planes and 3 single engine planes was operated in support of enforcement as well as fishery research activities.

Events stemming from approval of the Alaska Statehood Act on July 7, 1958, will bring about the transfer of jurisdiction over the fisheries of Alaska from the Federal Government to the new State effective January 1, 1960. With the advent of statehood, the Alaska commercial fishery regulations issued by the Department of the Interior on March 13, 1959 included a general prohibition of the use of salmon traps, to reflect the wishes of Alaskans in the disposition of their natural resources. In recent years these traps have taken 20 to 40 percent of the total Alaska salmon catch.

Columbia River Fisheries Program

The accelerated development of the waters of the Columbia River for power, navigation, flood control, and irrigation continue to pose complex problems in connection with maintenance of the salmon and steelhead runs. In addition to new research results from studies concerning passage of fish at high dams, considerable experience was gained during the year from the operation of fingerling trapping devices at several high dams in the Columbia Basin. The demonstrated efficiency of these facilities must be based on the success of the returning adult fish several years hence.

A review report was completed for the Columbia River Fisheries Development Program summarizing the results of the Program to date and including recommendations for future activity. Some 1,200 miles of streams have been improved through removal of barriers such as log jams and splash dams, 15 major fish ladders have been constructed, over 400 fish screens have been installed, and 20 hatcheries have been rebuilt or newly constructed since inception of the program in 1949.

The report contains the recommendation that further hatchery construction be deferred pending determination of the effectiveness of the existing hatcheries and that, for the present, new projects be directed toward stream improvement, particularly in the upper portions of the basin, and toward research, especially in regard to disease, nutrition in hatcheries, fish passage at high dams, and appraisal of program results.

Pribilof Islands Fur Seals

During 1958, the U.S. Government-operated fur sealing industry of the Pribilof Islands, Alaska, produced 78,919 fur sealskins, 85 percent of which were delivered to Canada and 15 percent to Japan in accordance with paragraph 1 of Article IX of the Interim Convention on Conservation of North Pacific Fur Seals. An additional 375 sealskins were delivered to each of those countries under paragraph 3(a) of Article IX of the Convention. The fur seal industry also produced 317.7 tons of seal meal and 53,160.5 gallons of oil.

During fiscal year 1959, two public auctions of fur sealskins were held in St. Louis, Mo. The Government realized total gross receipts of \$2,824,332 from the sale of 46,388 sealskins. In addition, sales by competitive bid of fur-seal oil and meal brought \$60,201, f.o.b. Seattle. Total estimated obligations for administration of the Pribilof Islands and the fur seal industry, including biological research, are \$1,825,000, resulting in an excess of receipts over expenditures of about \$1,060,000 for fiscal 1959.

During calendar year 1958, the Bureau chartered three fishery vessels to initiate a fur-seal research program at sea. A total of 7,024 seals were seen and 1,503 were collected between the latitude of southern California and Bering Sea.

Office of the Administrative Assistant Secretary

1. Otis Beasley, *Administrative Assistant Secretary*



THE ADMINISTRATIVE ASSISTANT SECRETARY is responsible to the Secretary of the Interior for the direction and supervision of the administrative management activities of the Department, including the development of policies and objectives relating to administrative management.

The Office of the Administrative Assistant Secretary is made up of seven divisions: Administrative Services, Budget and Finance, Inspection, Management Research, Personnel Management, Property Management, and Security. Highlights of the varied activities of the Office during the past year follow:

Division of Administrative Services

Floyd E. Dotson, *Director*

The Division operates centralized service facilities for the Office of the Secretary and other departmental and bureau offices in the Washington metropolitan area, and provides staff guidance in the field of administrative services for the entire Department. In fiscal

1959, work load and responsibilities remained approximately unchanged from 1958. Accomplishments during the year included:

(1) A new merit promotion plan was developed and installed in line with the government-wide program.

(2) Paperwork improvement studies continued, with Division employees actively engaged in a variety of employee training programs.

(3) Selective job classification surveys were conducted in various Departmental Offices.

(4) Installation of new lighting in the Central Library reading rooms raised the light level while reducing power costs 42 percent.

(5) Expenditures from all funds amounted to approximately \$9,000,000 and operations financed under the Working Capital Fund totaled \$1,800,000.

(6) An extensive modernization program for the Departmental Museum was launched, with immediate benefits in visitor understanding and interest; existing dioramas are being up-dated, and more use is being made of action-type exhibits.

(7) Continued development and application of records disposition techniques resulted in the destruction of more than 1,500 cubic feet of surplus documents.

Division of Budget and Finance

Sidney D. Larson, *Director*

The Division of Budget and Finance provides staff supervision over the financial management program of the Department of the Interior. This includes budgeting, accounting, auditing, financial reporting, fiscal policies and procedures, and the application of data processing to financial activities. The Division represents the Department in this field in liaison with the General Accounting Office, Bureau of the Budget, Treasury Department, and other Federal agencies, and appropriation committees of Congress.

During the past year regular budgets were processed for the Bureau of Reclamation and the Power Marketing Agencies and for the other bureaus, in addition to two supplemental budgets. A new format was developed for presenting appropriation estimates.

Congress designed to present requirements in a concise and more easily understandable manner.

Special analyses of increased pay costs were made for the Bureau of the Budget and the Congress and work continued on coordinating the bureaus' budget structures with their organization patterns. Instructions for the preparation of estimates to the Bureau of the Budget and Congress were published in annual form. The Division cooperated in developing legislation designed to place the programs of the Power Marketing Agencies on revolving-fund bases.

Efforts were continued to improve the accounting and financial management systems of the bureaus of the Department. Effective July 1, 1959, the Bureau of Land Management converted to an annual basis of accounting. The Geological Survey submitted to the Comptroller General for approval an integrated procedure covering personal services, payroll and leave accounting. For other bureaus, the year's program involved a continuation of the improvement of their financial management programs in cooperation with the Bureau of the Budget and General Accounting Office.

In fiscal year 1959 the Division reviewed and took action as necessary on a total of 47 audit reports issued by the General Accounting Office, and 136 internal audit reports rendered by Interior bureaus.

Division of Inspection

W. Darlington Denit, *Director*

The Division of Inspection is responsible for the inspection and investigative activities of the Department. The primary purpose of the Department's Inspection Program is to insure high ethical standards in the management of the Department's affairs. The Division of Inspection provides policy guidance and coordination for the program.

During the past fiscal year special attention has been devoted to the analysis and restatement of regulations of ethical import. The statement of ethical principles contained in the Code of Ethics for Government Service, passed by the Congress of the United States July 11, 1958, was the subject of special review and revised departmental rules of conduct developed in collaboration with

staff divisions were issued. New regulations based on special studies concerning outside employment are being developed.

The investigative program embodies special investigations of alleged administrative irregularities in the discharge of official duties. During the past fiscal year, investigative work was maintained on a current basis.

The Division of Inspection also has responsibilities in Departmental handling of matters under the Government Employment Policy enunciated in Executive Order 10590 and related Departmental regulations. Policy administration and enforcement were successfully continued.

Division of Management Research

Arthur B. Jebens, *Director*

The Division of Management Research has the primary staff responsibility for the improvement of the general management organization throughout the Department. This includes continuous review of Departmental operations to ensure the most efficient and effective use of manpower, funds and equipment.

During the past year this Division has participated in a number of management studies and provided management assistance in a variety of projects including:

(1) A study of the organization, procedures, and operations of the Office of Saline Water.

(2) A study of the organization and management of the Bureau of Reclamation consisting primarily of a review of Regions 6 and 7 in the Missouri River Basin and the Office of the Assistant Commissioner and Chief Engineer in Denver, Colo., with some work on and staffing data collected on a bureauwide basis.

(3) Coordinated the preparation of the Emergency Operations Handbook outlining the Department's policies and procedures for emergency planning and operations of the Department in the event of enemy attack.

(4) Prepared a policy statement and procedures for inclusion in the Departmental Manual relating to the administration of claims against the Government.

5) Undertook a procedures study of the Circulation Unit of the Department Library.

The Division's Branch of Directives Management administered a system for the preparation, review, and issuance of Secretarial directives. More than 240 documents were processed for Secretarial action. Of these, 123 were Federal Register documents; 72 were Departmental Manual releases; and 25 were proposed Presidential documents.

Under the Incentive Awards Program there has been a 13 percent increase in suggestions and a 100 percent increase in Distinguished Service Awards. The following statistics reflect the 1950 activities in the Incentive Awards Program:

| | |
|-----------------------------------|-------|
| Suggestions submitted | 5,226 |
| Superior Performance | 1,133 |
| Special Acts Award | 80 |
| Distinguished Service Award | 64 |
| Meritorious Service Award | 120 |
| Commendable Service Award | 368 |
| Valor | 7 |

Division of Personnel Management

Newell B. Terry, *Director*

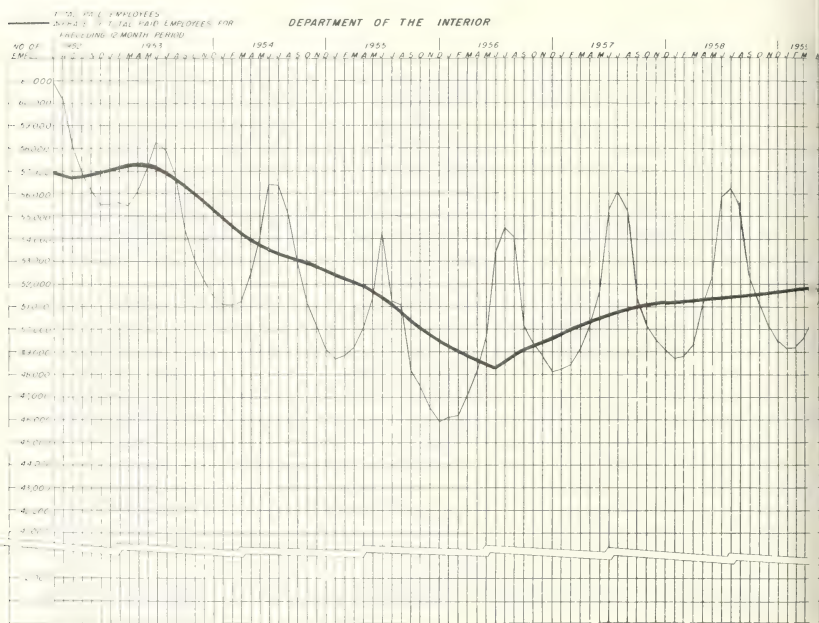
To give full effect to the new Government Employees Training Act a survey of training needs of each of the bureaus and offices was made, and the Departmental training policy was revised and strengthened. Standards were developed and responsibilities and controls for training were established. One hundred seventy-five requests of bureaus for approval of training in non-Government facilities were reviewed. Most were for short-term courses and programs in many varied fields.

After a study of more than 2 years, which included discussions and conferences with representatives of the Civil Service Commission and labor unions, Departmental Manual chapters were issued covering both labor relations policy and labor management negotiations. The first formal labor agreement in the Bureau of Indian Affairs and the 20th to be established in the Department was signed

with the International Brotherhood of Electrical Workers, Local No. 570, at Tucson, Ariz.

Four detailed safety conference guides with related visual charts were published for the use of bureaus and offices in furtherance of the safety program, and two safety instruction seminars were conducted, one for employees of the east coast area and one for employees of the Rocky Mountain area. The rate of disabling work injuries for each million man hours of employment is now at its lowest point in thirteen years.

A booklet entitled "Career Profiles" was prepared to provide college placement officers and students with interesting factual information on jobs in the Department. The booklet will serve the further purpose of publicizing within the Department the incentive awards and training programs. Also, a guide for appointing officers entitled "Judging Fitness for Federal Employment" was published.



Interview training has continued throughout the year and a new training course was conducted for personnel technicians covering nine aspects of employment procedures and problems.

All bureaus and offices of the Department developed and put in effect new promotion programs.

Division of Property Management

N. O. Wood, Jr., *Director*

Over 600 field personnel attended Property and Records Management conferences held in field locations. Operating instructions and procedures are being revised to reflect specific conference recommendations.

Forms Improvement Workshops were held in the Washington headquarters, with a total attendance of 218 middle-level officials. In addition, 125 Washington secretaries were given training on secretarial correspondence. Records disposal activities resulted in freeing over 51,000 cubic feet of filing space.

Personal property costing almost \$1 million was reassigned within the Department, minimizing the purchase of new equipment. Used equipment originally costing over \$11 million was obtained from other Federal agencies. Approximately \$1 million was realized from sales of obsolete equipment.

New developments in the purchasing and contracting field were incorporated in the Department's uniform regulations. Small Business participation in contracting increased from 64.7 to 65.4 percent during the first half of fiscal year 1959 and was extended to construction contracts and to sales of Government-owned timber.

Training of selected personnel in cryptographic communications was continued. A total of 234 radiofrequency assignments were made for the bureaus and offices. A Departmental CONELRAD (Control of Electromagnetic Radiation) spot-check program was established and an initial survey made. Relocation communication exercises were continued with increased staff participation.

Division of Security

J. Cordell Moore, *Director*

In the field of Physical Security, the training course for handling classified material was completed. Ten well-attended classes were held in Washington, D.C. These courses have brought a better

realization of the security responsibilities of Federal employees in sensitive positions.

Three conferences were held during the year designed to improve the procedures and preparations made by the Department to cope with disasters pursuant to the Division's responsibilities under Public Law 875, 81st Congress. The Department actively assisted other agencies in the mine disaster near Pittston, Pa., when the Susquehanna river broke into the Knox Mine during January 1962. Participating bureaus were the Bureau of Mines, the Geological Survey, and the Bureau of Reclamation.

In the field of Personnel Security, there was a continuing revision of sensitive positions designed to keep all clearances up-to-date; eliminate all unnecessary files; and to streamline procedures.

The Radiological Monitoring program of the Department has been materially advanced. Starting the year with about 100 employees trained in this field, the figure at the end of the year has risen to 631. Monitoring capability has now been established in three-fourths of the States including Alaska.

The Division of Security, by invitation of the Office of Civil and Defense Mobilization, now represents the Department on the Interdepartmental Committee on Radiological Defense. This is recognition of the capability which has been established by the Department in the field of radiation detection. The Department will also provide 450 stations to the Federal Radiological Monitoring network.

Office of the Solicitor

George W. Abbott, *Solicitor*



NY LEGAL PROBLEMS were presented during fiscal year 1958 involving complex Federal-State questions arising out of the establishment of Alaska's government, courts, and the administration of its resources under the Statehood Act and the Alaska Constitution. Among others, opinions were prepared concerning the continuation of Federal regulatory laws in Alaska, the classification of terms of office of the first United States Senators, and the suffrage applicable to the initial Alaska elections. Problems also arose in connection with Statehood for Hawaii, particularly the necessity for reapportionment with respect to its first State Legislature. The sharp increase in the appeals to the Secretary from the decisions of the Director of the Bureau of Land Management continued at an accelerated rate. A total of 426 appeals were received, which is an increase of 89 percent over fiscal year 1958. This appeals workload, together with a comparable increase in appeals to the Director, became so serious that a special committee was established to study and make recommendations to alleviate the situation. Action has not yet been taken on these recommendations.

The Board of Contract Appeals disposed of 27 cases and in eight other cases appeals were withdrawn, or otherwise disposed of, without any decision. In nine of the 27 cases, there are involved questions relating to requests for extensions of time of performance of the contracts in order to avoid liquidated damages.

Much work has been done in reducing the number of "backlog" probate cases which were pending before Inheritance Examiners on June 30, 1955. The 2,454 such cases which were on hand at that time have been reduced to 79. At the same time, Inheritance Examiners had decided 5,222 cases of the 6,983 "new" cases filed through June 30, 1955.

Many opinions were rendered which facilitated the economic development of tribal and individually owned Indian lands, or have assured protection to the Indians in the use and development thereof. Noteworthy in these opinions is the one solving the difficult legal problem of equalization of allotments and the leasing or other disposition of the valuable Palm Spring, Calif., Indian-owned land.

In each new Congress the number of requests by the congressional committees for reports on bills introduced increases. For a comparison, during the first session of the 84th Congress, 656 requests were received; during the first session of the 85th Congress, 721 requests were received; and during the first session of the 86th Congress, 952 requests were received.

The enactment of the Boulder City Act of 1958 (72 Stat. 1736) resulted in a considerable volume of work for the Los Angeles region. This act authorizes the Secretary of the Interior to sell Federal-owned housing in Boulder City which is not needed in connection with the administration, operation and maintenance of Federal activities located within or near the Boulder City municipal area.

Progress has been made in placing patent application work on a more current basis. It is anticipated that most cases will hereafter be considered for patent action within 12 months of submission. Nine patents were granted to the Department during fiscal year 1959, based upon researches conducted for the public benefit. One of these patents covers the so-called hot carbonate process for gas purification developed by the Bureau of Mines, which is now in extensive industrial use.

Regulations were prepared and published for the administration of the exploration program by the Office of Minerals Exploration. Regulations to implement the provisions of the Boulder City Act of 1958 were drafted and published in the Federal Register. Regulations were also issued improving procedures, encouraging wise use and development of natural resources, or implementing new legislation. One of these governs allotments to Indians, Aleuts, and Eskimos; another governs mining, development and utilization of mineral resources on public lands withdrawn or reserved for power development.

An important change in the contractual relationship between the Bonneville Power Administration and the four privately owned utility companies in the Pacific Northwest was effected. On September 1, 1958, certain provisions of the 20-year power sales contracts became effective for the first time and the regular Bonneville Power Administration rate schedules were applied to the private

companies in lieu of the special rates that had therefore been available to them.

The Denver Region has initiated the Davis and Featherstone oil and gas lease contests to effect the administrative cancellation of oil and gas leases obtained from the Government through alleged violation of acreage limitations. There follows a list of important cases decided by or pending in the courts and some administrative decisions. Cases of interest to the Bureau of Reclamation will be found in the "Litigation" part of the report of the Commissioner of Reclamation.

St. Marys Seamer Pipe Company v. Director of the U.S. Bureau of Mines (262 F. 2d 378). The court sustained an order issued by a Federal coal mine inspector under the Federal Coal Mine Safety Act, classifying a coal mine as "gassy" where methane seeped into it from an abandoned gas well penetrating the coal seam. *Monzo A. Adams v. Paul B. Witmer et al.* (No. 15859 U.S. Ct. of Appls., 9th Cir.). A mining claimant, whose claims had been declared null and void on appeal to the Secretary, could maintain an action against the manager of the Los Angeles land office to enjoin him from canceling the claims on the land office records, and the Secretary was not an indispensable party to the action. A petition for rehearing has been filed.

Chetikan Packing Company et al. v. Fred A. Scaton, etc., et al. (17 F. 2d 660). The Secretary acted within his authority in banning fish traps in Alaska.

Wade McNeil v. Scaton (No. 648-58, U.S.D.C., D.C.). A special rule adopted under the Federal Range Code was not invalid because it was not adopted in conformity with the rule-making requirements of the Administrative Procedure Act. This was based on the ground that the rule involved public lands, so came within the exception of "public property" exempted by the act from the rule-making provisions. The Department has taken this position since the enactment of the Administrative Procedure Act.

United States v. Edgar Camp (Civil No. 1551, U.S.D.C., E.D. of Washington). The Secretary has authority to regulate grazing and to require tribal members to obtain permits and pay fees for grazing on allotted lands on the reservations of tribes which did not reorganize under the Indian Reorganization Act of 1934.

State of Washington, ex rel., Zempel v. Denney (153 Washington Advance Sheets, No. 26). The effect of this case is to vest full criminal and civil jurisdiction, on many Indian reservations in Washington, in the State courts. The case has been appealed to the United States Supreme Court.

Larsen-Meyer Construction Company (Bd. of Contr. App., I.D. 463). The unusualness of the weather on a stormy day can be determined merely by measuring the severity of the weather that particular day against the average weather for the same in prior years, but must be determined on a basis that takes account of the frequency with which days of like or greater severity occurred during the same months or seasons of prior years.

Lord Brothers Contractors (Bd. of Contr. App., 66 I.D. 34). "changed conditions" claim of a tunneling contractor which encountered a continuous stretch of tuff or tuff breccia of approximately 3,000 feet in variable volcanic material in excavating tunnel approximately 3,600 feet long was rejected in view of geological evidence.

Inter-City Sand and Gravel Company and John Kovtynov (Bd. of Contr. App., 66 I.D. 179). Contractors encountered hard material in constructing a dam. A "changed conditions" claim rejected on the grounds that such hard material was indicated, and that the contractors had not conducted an adequate site investigation. The decision announced the doctrines that whether or not logs of exploration could be regarded as unqualified representation must depend on the circumstances of each individual case, and that the duty of conducting an adequate site investigation was enjoined in both first category cases, involving misrepresented conditions, and in the second category cases, involving unanticipated conditions, although the standards of adequacy might be less rigorous in the first than in second category cases.

Bushman Construction Company (Bd. of Contr. App., 66 I.D. 156). When the last day on which an appeal may be taken from findings of fact under the "disputes" clause of Government contract falls on a day that is a State, but not a Federal, holiday, the time for taking the appeal is not extended to the next business day.

M-36549 (February 3, 1959). Indians of the Palm Springs Reservation executed separate agreements with their lessees who held approved leases on restricted Indian lands. The obvious purpose of such agreements was to extend the lessees' tenure beyond the term of the approved leases, or to require the Indians to purchase improvements on the lands. Such agreements were invalid, insofar as they attempted to bind restricted Indian property, without the required approval of an officer of the Department.

Technical Review Staff

John B. Bennett, *Director*



URING FISCAL YEAR 1959, the Technical Review Staff continued its work of coordinating the interests and responsibilities of the Department of the Interior in the minerals, fuels and fisheries fields, as affected by and as they might affect the work of United States' participation in the General Agreement on Tariffs and Trade (GATT). The TRS supplied a departmental representative on the United States delegations to the meetings of the Contracting Parties of GATT and several of its committees and working parties at meetings held in Geneva, Switzerland.

Similarly, foreign trade problems taken up in other international forums were coordinated through the TRS. Arrangements were made for experts on United States delegations to many other international conferences in the natural resources field.

An agreement was negotiated with the Department of State to improve foreign service reporting on worldwide minerals, fuels and fisheries developments, including the establishment of a minerals and fisheries attache program within the Foreign Service administered by the Department of State.

The TRS arranged for official visits to the Department of foreign dignitaries and officials, scientists, and students interested in exchanging information.

With completion of the International Geophysical Year there has been a reorientation of the United States program in Antarctica, which has involved the Department to a greater extent than heretofore. The TRS has continued to coordinate Antarctic matters within the Department and to provide representation on the Operations Coordinating Board Working Group for Antarctica, which recommends operating policy and programs.

Defense Mobilization

The TRS continued to represent the Department as principal or alternates on various interagency groups developing defense mobilization plans. It provided staff support to the Assistant Secretary (Defense Activities) in coordinating certain aspects of the Department's defense functions and programs. Included in the groups are the Mobilization Plans Group and Interagency Planning Group of the Office of Civil and Defense Mobilization, the Industry Evaluation Board, the Interagency Committee on Essential Survival Items and the Interagency Advisory Committee on Essential Activities and Critical Occupations. During fiscal year 1959 substantial time was spent on assisting in the preparation and review of Annexes to The National Plan for Civil Defense and Defense Mobilization, published by OCDM in October 1958.

The Technical Inter-Agency Power Group, composed of representatives from Office of Civil and Defense Mobilization, Departments of Defense and Commerce, and the Federal Power Commission, and chaired by a member of TRS, conducts studies to evaluate the adequacy of electric power under mobilization conditions. On June 29, 1959, the group submitted its "Report of Reconnaissance Power Survey of the Greater Anchorage-Fairbanks Area of Alaska" to the Director, Office of Civil and Defense Mobilization.

The TRS represents the Department on the National Rural Fire Defense Committee. During the year a national plan for rural fire protection was developed by the Committee and placed before the Office of Civil and Defense Mobilization. This plan provides for the inclusion of some 546 million acres of forest, brush, marsh, tundra and grass lands administered by this Department within the national plan for fire control action.

Soil, Moisture, and Weed Control

The TRS has continued to provide technical assistance and act in a coordinating capacity for the soil and moisture, weed control and watershed protection programs of the Department. In the area of soil and moisture conservation, increased emphasis has been placed upon closer coordination with bureau field activities as related to both programing and development. A general program reappraisal was conducted of requirements based on changing conditions, more detailed inventory surveys, and general program requirements. Administrative and procedural changes designed to facilitate program execution were recommended.

Through its chairmanship of the Departmental Weed Control Committee, the TRS serves as a medium for an exchange of the most recent weed control techniques and procedures.

Interdepartmental and intradepartmental coordination activities relative to the Watershed Protection and Flood Prevention projects (Public Law 566) increased during the year, due primarily to accelerated local participation, program planning, and an increase in the number of approved projects.

Forestry

The TRS assisted in coordinating the activities to carry out responsibility under the act of August 13, 1954, as amended, the Klamath Termination Act. During the year three major phases were completed: (1) a review of the appraisal as required by law; (2) transfer to the U.S. National Bank of Portland, Oreg., as trustee, of those properties assigned to the Klamath Indians voting to remain as a unit; and (3) sale of most of the real property outside the designated boundaries of the Klamath forest.

The TRS coordinated the preparation of a 113-page report to the Chairman, Committee on Government Operations, with respect to the recommendations contained within House Report No. 2960 on Federal timber sales policies. One of the recommendations would have provided for the consolidation of the commercial forests of the Department of the Interior with those of the Department of Agriculture. This Department was not in agreement with the recommendation. With respect to most of the other recommendations the Department has either taken affirmative action or is now in the process of carrying out such recommendations.

The TRS continued to coordinate the Department's forest and range fire, forest insect and tree disease control programs. During calendar year 1958 fire losses were considerably less than in 1957, although a greater number of fires occurred. In 1958 there were 3,700 fires compared to 2,471 in the previous year. However, the area burned over totaled only 856,242 acres as compared with 5,20,078 acres in the previous year. At the end of fiscal year 1959, however, lightning fires were reported heavy in Alaska and it is possible that the area burned over may be rather high for the 1959 fire season.

Prevention of serious losses from diseases and insects in the 183 million acres of forests and woodlands administered by the Department is the prime objective of the forest pest control program. During the calendar year 1958 approximately 1,400,000 acres were

destroyed on 27,000 acres in the protection of the white pines from the ravages of blister rust (an introduced disease). During the year the Department was confronted by the following major forest pests in epidemic proportions: Mountain pine beetle at Grand Teton, Lassen Volcanic, and Yosemite National Parks; lodgepole needleminer in Yosemite National Park; dwarf mistletoe in the Mescalero Reservation; and spruce budworm on public domain in Montana, intermingled with private and national forest lands.

The Department is represented by a member of the TRS on the Organizing and Executive Committees for the Fifth World Forestry Congress, which will be held at the University of Washington, Seattle, Wash., August 29–September 10, 1960.

Conservation Bulletin No. 41, "Highlights in the History of Forest and Related Natural Resources Conservation" was completed by TRS during the year. This bulletin sets forth in chronological sequence the major actions affecting the Department in the field of forest and related natural resources conservation from 1890 through 1958.

Staff Service

The TRS continued to carry staff responsibility for the technical aspects of the Department's program for the improvement of property appraisal procedures through consultation with the Bureau on such matters as appraisal staffing, procedures, and training, through attendance at bureau appraisal training conferences.

The TRS provides staff service to the Secretary in connection with his duties as Chairman of the President's Council on Youth Fitness; to the Under Secretary in his capacity as liaison with the Outdoor Recreation Resources Review Commission; to the Assistant Secretary for Water and Power in the work of the Inter-Agency Committee on Water Resources; and to the Secretariat on special problems.

A major step in connection with the Department's field committee activities was the reactivation of the Alaska Field Committee, which had been dormant for a number of years. This brings the total number of field committees in operation to six.

Continuing operations of the TRS include the provision of liaison with the Bureau of the Budget on coordination of statistical standards and programming of surveying and mapping; with the National Science Foundation; with the Atomic Energy Commission on its "Operation Plowshare" program; and with other Federal agencies on program matters of mutual concern.

Oil Import Administration

Captain Matthew V. Carson, Jr. (USN), *Administrator*



THE SECRETARY OF THE INTERIOR, pursuant to Presidential Proclamation 3279, dated March 10, 1959, established the Oil Import Administration within the Department, issued regulations for the operation of an oil import program, and delegated the authority conferred upon him by the President to the Administrator. The objective of the oil import program is to insure a stable, healthy petroleum industry within the United States capable of exploring for and developing new domestic petroleum reserves. The basis of the program—like that of its predecessor voluntary program—is the certified requirements of national security. In administering the program, the staff of the Oil Import Administration:

Analyzes data prepared by the Department's Bureau of Mines relating to petroleum demand in the United States, by commodity type and petroleum districts, in order to set the overall amounts of crude and unfinished oil, residual fuel oil, and finished petroleum products to be allowed into the United States and Puerto Rico.

Analyzes applications from prospective petroleum importers to determine their eligibility under Oil Import Regulation 1, as revised, for semi-annual oil import allowances of crude oil and its principal derivatives.

Establishes equitable semi-annual oil import allocations for individual eligible oil importers by product type and district and issues import licenses.

Analyzes monthly reports from each importer showing the amount and disposition of petroleum imports entering the Nation under license and issues public reports concerning the oil import situation and the administration of the program.

5. Responds to an increasing volume of requests for information concerning the administration of the program from Congress, the press, and the public.

Summary of Activities

The Oil Import Administration issued regulations concerning activities, upon approval of the Secretary of the Interior, on March 13, 1959, and set the maximum allowable import levels for the allocation period ending June 30, 1959.

On March 17, 1959, the Oil Import Administration issued individual allocations to 136 eligible crude and unfinished oil importers in the United States and Puerto Rico for the March 11-June 30 period.

The Administration inaugurated on April 1 import controls for residual fuel oil and finished petroleum products in accordance with the Presidential Proclamation establishing the program and issued import allocations to 46 eligible importers of these commodities.

During the period, the Oil Import Administration issued licenses for importation of crude petroleum and its derivatives to eligible importers according to commodity type and requested port of entry. In the initial allocation period the Administrator transferred 81 appeals to the Department's Oil Import Appeals Board.

Prior to the close of the fiscal year, the Administrator announced overall oil import levels for the allocation period July 1, 1959, through December 31, 1959, and issued individual oil import allocations to 225 eligible importers.

Oil Import Appeals Board

Royce A. Hardy, *Chairman*



THE OIL IMPORT APPEALS BOARD was established on March 13, 1959, to hear petitions and appeals by persons affected by the Mandatory Oil Import Program established by the President on March 10, 1959.

On the grounds of hardship, error, or other relevant special consideration, the Board is authorized, within specified limits, to modify any oil import allocation granted by the Oil Import Administration; to grant an allocation of crude and unfinished oils, under special circumstances, to persons with importing histories who do not qualify for allocations; and to review the revocation or suspension of any allocation or license.

During fiscal 1959 the Board rendered 34 decisions on 38 appeals within the jurisdiction of the Board, and dismissed 29 other petitions because the Board has no authority to consider them. Thirteen appeals were withdrawn, and one was transferred to the July 1-December 31, 1959 allocation period.

Of the 38 decisions of the Board, 26 followed public hearings. In 12 appeals decided by the Board, public hearings were not requested by the appellants and none was required by the Board. In six appeals, the Board granted relief based upon grounds of special circumstances, importing history, and error.

In denying relief in the remaining 32 appeals, the Board found in most instances that the appellants had not established sufficient hardship to warrant relief. In the other instances the Board decided it had not authority to correct the alleged errors under or to permit carryovers from the Voluntary Oil Import Program under which it had no functions; to modify allocations of finished and unfinished products; to grant credits for bartered oil; or to grant relief based upon contracts antedating the Mandatory Oil Import Program.



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